

# ONR Technical Report



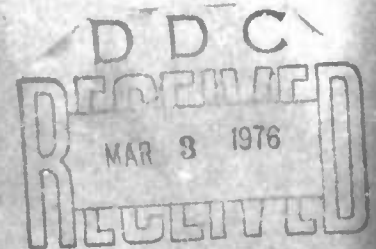
ADA021314

## IS BEHAVIOR IN A COMMONS DILEMMA GAME RELATED TO REAL WORLD BEHAVIOR?

Jeanne McTavish

### DISTRIBUTION STATEMENT A

Approved for public release;  
Distribution Unlimited



A

This research was supported by the Advanced Research Projects Agency of the Department of Defense (ARPA Order No. 2449) and was monitored by ONR under Contract No. N00014-75-C-0093 (NR 170-770)

The views and conclusions contained in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the Advanced Research Projects Agency or the U.S. Government.

Reproduction in whole or part is permitted for any purpose of the United States Government.

Unclassified

Security Classification

DOCUMENT CONTROL DATA - R & D

Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified

1. ORIGINATING ACTIVITY (Corporate author)

Oregon Research Institute  
Eugene, Oregon 97403

unclassified

3. REPORT TITLE

6 Is Behavior in a Commons Dilemma Game Related to Real World Behavior.

9 4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Technical Report.

5. AUTHOR(S) (first name, middle initial, last name)

10 Jeanne M. McTavish

Elizabeth

12 100p.

11 6. REPORT DATE

3 November 1975

7a. TOTAL NO. OF PAGES

93

7b. NO. OF REFS

8a. CONTRACT OR GRANT NO.

15 N00014-75-C-0093

8b. PROJECT NO.

18 NR-174-770

9a. ORIGINATOR'S REPORT NUMBER(S)

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

ARPA Order 2449

10. DISTRIBUTION STATEMENT

This document has been approved for public release and sale; its distribution is unlimited.

11. SUPPLEMENTARY NOTES

12. SPONSORING MILITARY ACTIVITY

Office of Naval Research  
Code 455

Arlington, Virginia 22217

13. ABSTRACT

DDC  
RECEIVED  
MAR 3 1976  
A

DD FORM 1473 (PAGE 1)

1 NOV 65 S/N 0101-807-6801

unclassified

388 005  
Security Classification

14

Y. Y. WONG

1. King, 1994.

1. 100 2. 100 3. 100 4. 100 5. 100 6. 100 7. 100 8. 100 9. 100 10. 100 11. 100 12. 100 13. 100 14. 100 15. 100 16. 100 17. 100 18. 100 19. 100 20. 100 21. 100 22. 100 23. 100 24. 100 25. 100 26. 100 27. 100 28. 100 29. 100 30. 100 31. 100 32. 100 33. 100 34. 100 35. 100 36. 100 37. 100 38. 100 39. 100 40. 100 41. 100 42. 100 43. 100 44. 100 45. 100 46. 100 47. 100 48. 100 49. 100 50. 100 51. 100 52. 100 53. 100 54. 100 55. 100 56. 100 57. 100 58. 100 59. 100 60. 100 61. 100 62. 100 63. 100 64. 100 65. 100 66. 100 67. 100 68. 100 69. 100 70. 100 71. 100 72. 100 73. 100 74. 100 75. 100 76. 100 77. 100 78. 100 79. 100 80. 100 81. 100 82. 100 83. 100 84. 100 85. 100 86. 100 87. 100 88. 100 89. 100 90. 100 91. 100 92. 100 93. 100 94. 100 95. 100 96. 100 97. 100 98. 100 99. 100 100. 100

6148.

1461.

•

• • • • •

4

1000

44

DD

FORM  
1 NOV

1473

( BACK )

~~unclassified~~

**Security Classification**

## IS BEHAVIOR IN A COMMONS DILEMMA GAME

by

JEANNE ELIZABETH MCTAVISH.

## A DISSERTATION

Presented to the Department of Psychology  
and the Graduate School of the University of Oregon  
in partial fulfillment  
of the requirements for the degree of  
Doctor of Philosophy

June 1975

A

## ACKNOWLEDGEMENTS

I wish to sincerely thank the members of my dissertation committee (Robyn Dawes, Myron Rochbart, Fred Fosmire and John Orbell) for their help throughout this research.

I would also like to thank Bernie Corrigan for his advice on computer operation and programming. I learned much with his patient help. Special thanks are also extended to Cindy Page for her help on many aspects of the experiment.

I would like to extend special thanks to the entire staff of Oregon Research Institute for their patience during Experiment 1. Many staff members volunteered office space, and their time and efforts and were supportive in so many ways. I am especially grateful to Gerry Hanson, Kelley Roub, Nancy Collins, Barbara Mann, Mary Wilke, Dana Wilner, Sue Burroughs, John Howard, Mary Hornsby, Harriet Shaklee, Sol Fulero, Kathie Adams, Mike Moore, Phil Hyman, Shirlynn Spacapan-Nichols, and John Fulcher.

This research was supported by the Advanced Research Projects Agency of the Department of Defense (ARPA Order No. 2449), and was monitored by ONR under Contract No. N00014-75-C-0093.

# TABLE OF CONTENTS

<u>Chapter</u>	<u>Title</u>	<u>Page</u>
I	INTRODUCTION. . . . .	1
II	PURPOSE AND DESIGN. . . . .	16
	Design Overview . . . . .	21
III	EXPERIMENT I. . . . .	24
	Method. . . . .	24
	Results . . . . .	30
	Discussion. . . . .	39
IV	EXPERIMENT II . . . . .	43
	Method. . . . .	43
	Results . . . . .	47
V	DISCUSSION. . . . .	56
	External Event Validity of the Commons Dilemma Game. . . . .	56
	Internal Variable Parameter Validity of the Commons Dilemma Game . . . . .	57
	Summary . . . . .	59
	APPENDICES. . . . .	61
	A--Estimation Tasks . . . . .	62
	B--Experiment I: Questionnaire 1 and Behavior Checklist I . . . . .	69
	C--Thurstone Scales--FORM 1 and FORM 2. . . . .	81
	D--Behavior Checklist FORM 3. . . . .	85
	E--Self Judgment: Experiment II. . . . .	88

# LIST OF FIGURES

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	A Model Examining Causation from Personality and Attitudes to Two Kinds of Behavior. . . . .	2
2	Design of Experiment I. . . . .	23
3	Loss Payoff Matrix for Eight Person Groups. . . . .	27
4	No Loss Payoff Matrix for Eight Person Group. . . . .	45

# LIST OF TABLES

<u>Number</u>	<u>Title</u>	<u>Page</u>
I	Mean Proportion Defecting in Each Condition . . . . .	32
II	Correlations of Game Cooperation, and Self and Friends' Judgments of Cooperativeness with Each Behavior Checklist Scale. . . . .	34
III	Correlations of Game Cooperation and Self and Friends' Judgments of General Tendency to Cooperate in Dilemmas with Each Behavior Checklist Scale . . . . .	36
IV	Correlations of Game Cooperation, Self and Friends' Judgments of Cooperativeness, and Proportion of Defections Predicted by the Subject with Two Thurstone Scales of Cooperation in Dilemmas and with Each Subscale of Behavior Checklist FORM 3 . . . . .	37
V	Correlations of Game Cooperation Self and Friends' Judgments of Cooperativeness, and Proportion of Defections Predicted by the Subject with Two Thurstone Scales of Cooperation in Dilemmas and with Each Subscale of Behavior Checklist FORM 3 . . . . .	40
VI	Correlations of Game Cooperation, Self and Friends' Judgments of Cooperativeness, and Proportion Predicted to Defect by the Subject, with Two Thurstone Scales of Cooperation in Dilemmas and with Each Subscale of Behavior Checklist FORM 3. . . . .	41
VII	Mean Number Defecting in Each Condition . . . . .	48
VIII	Correlations of Game Cooperation, Self Judgment of General Tendency to Cooperate in Dilemmas, and Number of Defections Predicted by the Subject, with Each Behavior Checklist Scale and Thurstone FORM 1 and Thurstone FORM 2 (for all participants) . . . . .	50



## CHAPTER I

### INTRODUCTION

Since the publication of Garrett Hardin's essay, "The Tragedy of the Commons" (1968), psychologists, political scientists, and economists have shown increasing interest in understanding the determinants of choice behavior in situations where an individual's own best interest conflicts with those of some larger group which includes him. Many writers have delineated a multitude of current social problems such as curbing pollution, limiting population growth, and providing for public goods (Campbell, 1965, 1972; Kahan, 1974; Messick, 1973; Orbell and Rutherford, 1973; Platt, 1973; Schelling, 1971, 1973) in which collective rationality and individual rationality conflict. (Rapoport, 1962)

This research attempts to assess the validity of a laboratory analogue of the commons dilemma: <sup>Whether</sup> Does behavior in a laboratory commons dilemma game (CDG) relate to behavior in real world commons dilemmas? Problems in the validation of games are discussed, and previous research linking game behavior to the personalities, attitudes and real world behaviors of participants is summarized.

In discussing the problems of validating games, Hermann (1967) points out that the criteria for validation vary according to the purposes for which the game was developed. CDG was developed for the purpose of hypothesis and theory construction concerning

the determinants of behavior in commons dilemma situations. The main task of efforts at validation, therefore, is to establish some degree of correspondence between the game and its reference system. This study takes the direct approach of comparing the behavior of participants in the game with their self reports of behavior in a variety of real world situations. Most previous research has attempted validation of games in a more removed way by examining the intervening variables of attitudes and/or personality. Previous efforts have focused on a model of the following nature: (See Figure 1).

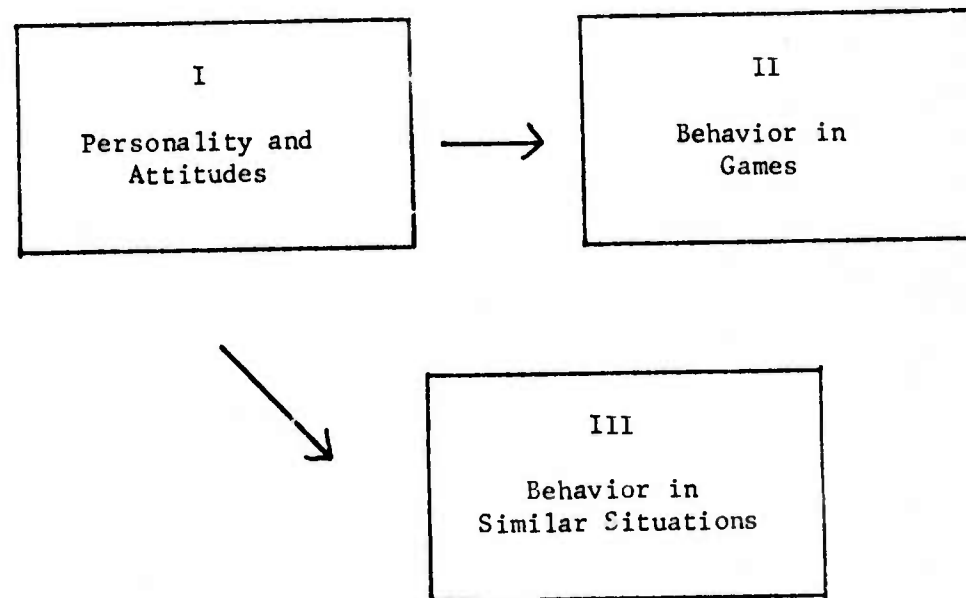


Figure 1. A Model Examining Causation from Personality and Attitudes to Two Kinds of Behavior

These efforts have attempted to establish the relationship between personality or attitudes and game behavior. Aside from the rather disappointing lack of relationship between I and II (Baxter, 1970), almost no attempt has been made to establish any correspondence between

II and III (Sermat, 1970, and Meux, 1973 are exceptions in this regard). A comprehensive review of research on the Prisoner's Dilemma game by Wrightsman, O'Connor, and Baker (1970) led them to conclude in assessing the generalizability of conclusions from research using mixed motive games, that the lack of established correspondence between real world behavior and game behavior was a crucial barrier to generalizability: "What surprises us most, in our review of the research, is that apparently no studies have compared degree of cooperative behavior in a laboratory mixed-motive game with cooperation in different real world tasks."

Before examining more closely previous research which has, like the present undertaking, attempted to establish a direct link between II and III, research linking personality and attitudinal variables to game behavior will be reviewed. Personality factors which have been studied will be discussed in order from those least promising as predictors to those most promising in that regard.

Several personality factors have been tested for relationships in only one experiment and have yielded nonsignificant relationships or no relationship at all. Wrightsman (1966) tested the following factors and found negative results relating to trusting or trustworthy choices in a two-trial sequential choice Prisoner's Dilemma game:

Chein's Anti-Police Attitudes

Chein's Personal Optimism

Agger's Political Cynicism (Also negative results in Uejio and Wrightsman, 1967)

Rehfishch Rigidity Scale

Berkowitz's Social Responsibility Scale

Other investigators have tested the following variables with negative or nonsignificant results:

Self acceptance. (No relationship to cooperative play in a disarmament game; Pilisuk, Potter, et al., 1965.)

Self esteem. (No relationship to reactions to martyr behavior in a Prisoner's Dilemma game; Wood, Pilisuk, and Uren, 1973.)

Rotter Interpersonal Trust Scale. (No relationship to cooperative behavior in a sequential choice Prisoner's Dilemma game; MacDonald, et al., 1972.)

Altruism. (No relationship to cooperation in four mixed-motive games; Bixenstine and Blundell, 1966. No relationship to cooperation in a six person Prisoner's Dilemma game; Bixenstine, Levitt and Wilson, 1966.)

Other personality factors have been tested at least twice with mixed findings. Relationships have been found but failed to replicate for the following variables:

The Radicalism/Conservatism Factor of the 16PF. (Positively related to cooperative behavior in a version of the Trucking Game; Mack, 1972. No relationship to cooperation in a Prisoner's Dilemma game; Gillis and Woods, 1971.)

Emotional Stability Factor of the 16PF. (Same findings as above; i.e., positive findings by Mack and no relationship by Gillis and Woods.)

Aggression. (As measured by the Gough ACL: positively related to defection in a Prisoner's Dilemma game; Marlowe, 1963. Failure to replicate; Noland and Catron, 1969. As measured by Buss-Durkee

Verbal Hostility: No relation to cooperation in a sequential choice Prisoner's Dilemma game; Wrightsman, 1966.)

Theoretical Values as measured by the Allport-Vernon-Lindzey study of values, might be expected to correlate with cooperative choice in a Prisoner's Dilemma game because cooperation is the riskier response and several studies have found Theoretical Values to be related to a preference for risk taking (Scodel, 1961; Scodel, Ratoosh and Minas, 1959; Conger, et al., 1957; Sherman, 1968.) Two studies failed to find any relation between Theoretical Values and cooperative choices in Prisoner's Dilemma games (Bixenstine and Blundell, 1966; Bixenstine, Levitt and Wilson, 1966). Dolbear and Lave (1966) failed to find a relation between risk preference and cooperation although all of six correlations were in the right direction. Mack (1972) is the only investigator reporting a positive relationship between Theoretical Values and Cooperation in a mixed-motive game (a variety of the Trucking Game).

Because failure to replicate findings of research relating personality to game behavior is quite common, those factors which have shown relationships but have only appeared in one study should be viewed with considerable skepticism. Such factors include:

Cooperativeness (as measured by the Test of Social Insight: positively related to cooperation in a Trucking Game; Mack, 1972).

Exhibition (as measured by EPPS: related to behavior in a Trucking Game; Mack, 1972).

Need for Power (as measured by the TAT: related to defection in a one-trial Prisoner's Dilemma game; Terhune, 1968).

Personal relations (as measured by the Guilford Zimmerman Temperament Survey: related to cooperation in a Trucking Game; Mack, 1972).

Self Disclosure (Jourard Scale: related to cooperation in a Prisoner's Dilemma game; MacDonald, et al., 1972).

A final category of personality variables includes seven variables which have been most extensively explored and while yielding some mixed results, show the most promise of being significantly related to game behavior, having been replicated at least once. These factors include:

Authoritarianism

Internationalism

Achievement

Cognitive complexity

Dominance

Flexible ethicality

Philosophies of human nature

One of the earliest and most widely quoted findings in this area is Deutsch's (1960) finding that authoritarians (California F. scale) are less trusting than non-authoritarians. Subjects played a sequential choice Prisoner's Dilemma game. They were classified as trusting if they made a cooperative choice when choosing first. Deutsch found a point biserial correlation of .50 ( $p < .001$ ) between authoritarianism and lack of trust. Two studies using the sequential choice method have replicated Deutsch's findings (Wrightsmann, 1966; MacDonald, et al., 1972). Using a regular Prisoner's Dilemma paradigm, three unpublished studies (c.f., Baxter, 1970) and one published study (McKeown, et al., 1967) failed to find a relationship between authori-

tarianism and cooperative choices. Two studies using other game measures of cooperation also report negative results. Fry (1965) failed to find a relation between authoritarianism and cooperation in a three choice tacit coordination game, and Wood, Pilisuk, and Uren (1973) failed to find a relation between authoritarianism and reactions to martyr-like behavior in a modified three-person Prisoner's Dilemma game. Klein and Solomon (1966) failed to find a relationship between F scale scores and cooperation by schizophrenics in a Prisoner's Dilemma game.

Another early and widely quoted finding is that people with internationalist views are more cooperative in games than are people with isolationist views. Lutzker (1960) administered a scale of internationalism to 484 subjects and paired the extreme scoring subjects in homogeneous, heterogenous or mixed pairs for a thirty trial game of chicken. He found that internationalist pairs made more cooperative choices, and were more likely to both cooperate (C,C) than were isolationist pairs. Competition did not increase over trials in internationalist pairs as it did in the other pairs. Similar findings are reported by McClintock, Harrison, et al., (1963) for a chicken game played by homogeneous pairs of extreme internationalists or isolationists. McClintock, Gallo, and Harrison (1965) found that internationalists were more cooperative to a cooperative strategy, but isolationists were uniformly competitive to either cooperative or competitive strategies when playing an assymetric Prisoner's Dilemma game. Sermat (1968) found a significant correlation between internationalism and cooperation in a chicken game.



Using games other than chicken, three studies have failed to find a relationship between internationalism and tendency to cooperate. Sherman (1968) compared choices among game matrices and did not find any tendency for internationalists to choose less competitive matrices. Pilisuk, et al. (1963) did not find any relation between internationalism and cooperation in a disarmament game. Bixenstine, Levitt, and Wilson (1966) found no relation between internationalism and cooperative play in a six person Prisoner's Dilemma game. The three failures to replicate all differ from Lutzger's study in not pre-selecting extreme internationalists and isolationists and in using different games.

Three studies suggest a relationship between need for achievement and cooperative game play by male subjects. Chaney and Vinacke (1960), using the Edwards Personal Preference Scale, created male triads consisting of one subject high on need for achievement, one high on nurturance and one intermediate. The high achievement subjects took an active role in initiating cooperative play in a board game allowing coalitions. Amidjaja and Vinacke (1965), using the French Test of Insight, replicated this finding for male subjects but not for females. Terhune (1968), using only male subjects, found that high achievement subjects (measured by the TAT) played one-trial Prisoner's Dilemma games more cooperatively. No failures to replicate have been reported and the relationship has been found for two different games and for three different measures of need for achievement.

Cognitive complexity has been found to be positively related to cooperation in two non-zero sum games (Phelan and Richardson, 1969; Baxter, 1970). The related concept of Tolerance for ambiguity, however,



has shown no relationship to cooperation in a disarmament game (Pilisuk et al., 1963), reactions to martyr behavior in a modified three-person Prisoner's Dilemma game (Wood, Pilisuk and Uren, 1973), or preference for less competitive Prisoner's Dilemma matrices (Sherman, 1968).

The personality variable dominance-submission has quite consistently shown a relationship to cooperative behavior in Prisoner's Dilemma and Chicken games. Marlowe (1963) found that deference and abasement on the Gough ACL were positively related to extreme cooperative choices in a Prisoner's Dilemma game. Noland and Catron (1969) report a failure to replicate the relationship between cooperative choices and ACL scales of dominance, deference and abasement. Marlowe used only male subjects and selected extreme cooperators and defectors for comparison. Noland and Catron used only female subjects and did not select extremes. Measuring dominance with the A-S Reaction Study of Allport and Allport, Fry (1965) found that pairs that were heterogeneous on dominance played a tacit coordination game more cooperatively than did homogeneous pairs. Moore and Mack (1972), using the A-S Reaction Study, found that pairs of dominant subjects playing a Prisoner's Dilemma game locked into defection (D, D) sooner than submissive or mixed pairs and that the proportion of defecting choices began and stayed highest in dominant pairs and lowest in mixed pairs. Two studies have shown that high scores on the MMPI dominance scale are negatively related to cooperation in Chicken games (Sermat, 1968; Sermat and Gregovich, 1966). Factor E (dominance-submission) of the 16 PF accounted for from 11 to 14% of the variance in cooperative behavior in a Prisoner's Dilemma game (Gillis and Woods, 1971). A failure to replicate this finding

for Factor E is reported by Mack (1972) using a Trucking game.

Two measures of concern with moral principals have been studied in relation to cooperative game behavior, with mixed results. Bixenstine's flexible ethicality scale showed a relationship to cooperation in a Prisoner's Dilemma game (Bixenstine, Potash and Wilson, 1963; Bixenstine and Wilson, 1963) but not in an assymetric non-zero sum game (Bixenstine, Chambers and Wilson, 1964). Factor G of the 16PF, reflecting concern with moral values, was related to cooperation in one Prisoner's Dilemma study (Gillis and Woods, 1971) but failed to replicate in a trucking game study. (Mack, 1972)

One attitudinal factor which might be expected to relate to one's choice in a mixed-motive situation is how trusting or favorable an attitude one has toward mankind in general. Wrightsman's Philosophies of Human Nature (PHN) scale was related to a trusting, cooperative response in a sequential Prisoner's Dilemma game. (Wrightsman, 1966) Uejio and Wrightsman (1967) found similar results for Caucasian and Japanese subjects playing a regular Prisoner's Dilemma game against a 76% cooperative strategy but only when they believed their opponent was Caucasian. Three unpublished studies (c.f., Baxter, 1970) found mixed, mostly negative results. Only some of the earlier findings were repeated, and not at statistically significant levels. Richman (1971) reports finding no relation between PHN scores and cooperation in either of two regular Prisoner's Dilemma games or in a sequential play Prisoner's Dilemma game.

In summary, relationships between personality and attitudes and tendency to cooperate in games have not been found consistently,

although a few variables such as authoritarianism, internationalism, dominance, flexible ethicality, PHN, and need achievement have shown replicable effects. Even for these variables occasional negative results are found, and positive findings are often questionable since subjects are selected as being extreme and results of ANOVAS are ambiguous in the sense that causal interpretations are open to the same criticism as causal interpretations of correlational findings. Subjects in the extreme groups may differ on other unmeasured dimensions because assignment to groups is non-random.

Even if a relationship between game playing behavior and certain personality and attitude variables could be established it would only be one step in the direction of establishing correspondence between games and the real world situations they are developed to study. A more direct approach to establishing such correspondence would be to compare the systems of game behavior to the real world behaviors to which these games are believed analogous. Only a few investigators have taken such an approach.

Sermat (1970) first tested the correspondence between subjects' behavior in a Prisoner's Dilemma or Chicken game and their behavior in another laboratory analogue of cooperation, the Paddle game. The second game was played from one to several months later and care was taken that subjects saw no connection between the two experiments. Pairs of like sexed subjects consisting of one member who had previously played consistently cooperatively and one member who had consistently played competitively were assigned the task of developing alternating use of a single channel. As predicted, the subjects who had previously

played Prisoner's Dilemma or Chicken very competitively succeeded in using the channel first in almost every pair.

In another experiment in the same series (Sermat, 1970) both Chicken and the Paddle game were played by pairs of subjects in the same experimental session. Considerable consistency of behavior was found; subjects who behaved competitively in one game situation tended to behave competitively in the other.

In the last experiment of this series (Sermat, 1970) extreme competitive or cooperative behavior in earlier Chicken or Prisoner's Dilemma games was tested for relations to behavior of a less game-like nature. Subjects first wrote stories about pictures under instructions stating that the experiment was designed to determine how well people used their imaginations. Subjects then read one another's stories and discussed them for twenty minutes under no pressure to reach agreement but with instructions saying the discussion was an opportunity to exchange ideas. Interaction was coded by observers using Bales Interaction categories. No significant difference was found between the behavior of previously cooperative or competitive subjects. Observers were asked to guess the game-playing strategy of the discussants and were unable to do so. After the discussion subjects were again asked to write their interpretations of the pictures. The amount of agreement in stories of pairs with similar game-playing behavior was higher than that shown in stories of dissimilar pairs. There was a non-significant trend for stories of competitive subjects to display more cynicism than stories of cooperative subjects.

In summary, Sermat found similarities between Prisoner's Dilemma and Chicken game behavior and behavior in another mixed-motive game but important behavioral differences between cooperators and defectors were not found in a more natural social interaction.

Kelley and Stahelski (1970) found evidence for a pattern of behavioral and perceptual differences in cooperators and competitors in a wide variety of game situations and in survey responses concerning how they would act and expect others to act in a student protest situation. Their triangle hypothesis may be briefly summarized as follows:

People differ in their dispositions to cooperate or compete.

Cooperators in interaction with competitors tend to become behaviorally assimilated, i.e., they respond to competition by becoming competitive, although in interaction with another cooperator they maintain cooperative behavior.

Cooperators are aware of their behavioral assimilation, but competitors do not realize the influence they are having over interaction.

Cooperators, therefore, develop a world view that others are heterogeneous with regard to cooperation/competition, but because competitors are unaware of the influence they are having in establishing competitive interactions, they come to regard the world as homogeneously competitive.

Evidence supporting the triangle hypothesis has been found in four different experimental games: Prisoner's Dilemma, Chicken, and two complex negotiation games, played in eight different laboratories including three in Europe. Two studies using survey responses concerning

how one would react and how one would expect others to react in a student protest situation also support the triangle hypothesis. Several studies concerning the social perceptions of high and low authoritarians also support the hypothesis. Some of these studies involved judgments made after actual observation or participation in relatively natural social interactions. Although no studies regarding the triangle hypothesis compare the behavior of the same people in both games and natural interactions, the patterns of behavior or behavioral intentions and social perception do correspond between settings.

Speer (1972) found considerable correlational evidence that the way married couples play Prisoner's Dilemma type games is related to the quality of communication between them (Primary Communication Inventory) and their marital satisfaction (Marital Adjustment Test) as measured with self report scales.

The one study most closely related to the present research was an attempt to relate behavior in a laboratory analogue of the commons dilemma to subjects' self predictions concerning a variety of real world dilemmas. Meux (1973) preselected extreme male and female subjects on the basis of their self predictions of behavior in four situations:

Use of a car in Los Angeles.

Compliance with a Presidential request to delay expenditures to fight inflation.

Taking a paper clip from one's office while knowing that money used to replace paper clips could be used for a fellowship.

Comments about intended family size.

She found that females who predicted that they would react most coopera-

tively to the real world dilemmas actually made more cooperative responses in a twelve-person Chicken game played in groups balanced for self prediction and sex.

In summary, four investigators have attempted to establish links between game behavior and real world behavior. Sermat (1970) found that subjects played several games, widely separated in time, in a consistent manner. However, their game behavior did not predict their style of interaction in a discussion. Kelley and Stahelski (1970) found a correspondence between one's own cooperative or competitive orientation and one's expectations of other's behavior both in a wide variety of game situations and in self predictions concerning a real world student protest situation. Speer (1972) found a correspondence between the way married couples played mixed-motive games and their communication and marital adjustment. Meux (1973) found a relationship for female subjects between cooperation in an n-person Chicken game and their self prediction concerning behavior in real world commons dilemmas.



## CHAPTER II

### PURPOSE AND DESIGN

The purpose of this research was to begin to validate a laboratory Commons Dilemma Game (CDG) as an analogue useful for hypothesis and theory construction concerning the determinants of behavior in commons dilemma situations. The basic design consisted of having subjects play one trial of the CDG with a group of strangers and then fill out a questionnaire concerning their past behavior (and some behavioral intentions) in real world commons dilemma situations. The game is, of course, one instance of real world behavior. The subject must either cooperate or defect and his choice has real monetary consequences for himself and the others in his group. The question is whether the game behavior relates to behavior in large scale social dilemmas. Behavior in the game was then compared to questionnaire results. The subject himself and three of his friends also rated the subject concerning his typical orientation in commons dilemma situations. A second study was run to cross-validate selected questionnaire forms. In this section the CDG is formally defined and some criteria for validation are discussed.

Commons dilemmas are situations in which individuals are faced with a choice between acting in their own short-term best interests, at some cost to society (a defecting choice, D), or acting in the best interests of the group at some cost to themselves (a cooperative choice, C). In the CDG, each player has a choice between two actions,



C or D, and each has the same payoff structure. CDG is defined formally by the following three conditions (Dawes, 1974):

Each player who chooses D rather than C has his payoff incremented by an amount  $d > 0$  above the payoff  $C(N)$  for total cooperation.

Players are collectively fined  $d + \lambda$  ( $\lambda > 0$ ) for each choice of D, each player's share of the fine being  $(d + \lambda)/N$ .

$$d > \frac{\lambda}{N-1}$$

The definition guarantees that defection is a dominating strategy that results in a deficient equilibrium (if all choose D they are worse off than if all choose C, but no player is motivated to change his decision). Furthermore, everyone is better off the more people choose C. For proofs regarding the structure resulting from conditions 1-3, and for a discussion of the relationship of CDG to other dilemma games see Dawes, 1974.

Hermann (1967) discusses five criteria for establishing a correspondence between a game and its reference system. The first is internal validity. Do replications of the game yield similar results? Some of the results to be reported later will reveal replications of effects under both identical and similar conditions.

The second criterion is that of face validity: the initial impression of the game's realism. During the pretesting of the CDG, experimenters were deeply impressed by the seriousness with which subjects approached the game situation. When one set of subjects played the CDG in a classroom for real money,<sup>1</sup> the only two defecting subjects were later unable or unwilling to keep their "ill gotten gains" of \$14.00 each. Responses were completely anonymous, yet both defectors

<sup>1</sup>Two fifteen-person groups played CDG with  $C = \$2.00$ ,  $D = \$13.00$  and  $\lambda = \$2.00$ .

insisted upon volunteering confessions to the class the very next day. One subject announced that he had regretted his choice and donated the money to a church charity. The other defector gave a long speech concerning the necessity of cooperation in real world dilemmas and then returned the money he had won to his classmates, each of whom had suffered some reduction of winnings due to his defection. When the game was played by a group of senior citizens, one defector called the experimenter's secretary twice (once late at night) to explain that he was not really a bad person but had been a stockbroker for many years and had made the economically rational choice, but now found it difficult to sleep. During the actual experiment reported here, participants who defected sometimes asked if there was a back door so that they might leave privately even though they were paid individually and none of their game group would know who had defected. The face validity was strikingly, even disturbingly, high. In conditions where subjects were allowed to discuss their choices, discussions were usually serious, often tense, and almost always included subjects' spontaneous comments regarding analogous real world dilemmas and the ethical implications of choices.

Two other types of validity are variable--parameter validity and hypothesis validity. Do variables or parameters affecting game behavior have similar effects upon real world behavior? The present research has uncovered systematic effects of some variables, but validation awaits demonstration of similar effects on real world dilemmas.

The fifth type of validity is event validity: the comparison of events (including patterns of behavior) in the game and in the reference system. The present research concerns attempts to show a relationship between defecting in the game and self report of a variety of past behaviors in real world commons dilemmas. For example, subjects' cooperation or defection in the game is compared to their cooperation with requests to limit driving during recently past pollution alerts and energy crises.

Hermann (1967) also discusses four validity questions directly related to the use of human participants in a game designed to model a real behavioral system.

The first of these is the question of representativeness. Do the participants in the game differ in any systematic way from actors in the reference system? Participants in the current research were recruited by newspaper advertisements in both the student newspaper and the local daily newspaper. The impression of experimenters was that the sample over-represented students, young and adults, and unemployed people. Whether such people react differently to commons dilemmas than the general population does cannot be answered by the present research. Some observers have also commented that Eugene, Oregon may contain an unrepresentatively large proportion of people with a cooperative orientation toward commons dilemmas, and that people from Eugene may have an unusually high degree of assumed similarity to one another which might also influence their propensity to cooperate with one another. Any findings from the present research, therefore, would require replication on other populations for confident generalization.

A second problem Hermann discusses is the assignment of players to unfamiliar roles. This does not appear to be a serious problem in the current research. As mentioned earlier, subjects' spontaneous comments do indicate that subjects do find the situation similar to many real world decision situations. This validity problem would probably be more important to address in such games as those simulating inter-nation conflict.

A third validity problem with human participants is an internal validity problem. Do participants, consciously or unconsciously, introduce new elements into the game during different trials or runs of the game? This could be a problem in CDG, especially when played with communication. It is possible that participants could introduce leadership styles or other variables that would reduce the internal validity of the game. However, replications of conditions should allow some assessment of such effects, which could then be subjected to systematic study.

The final, and perhaps most important validity question posed by the use of human participation is whether players experience motivations in the game which are similar to those of actors in the reference system. One attempt to deal with this problem in the current research was the use of real payoffs varying from losing \$8.00 to winning \$10.50. The monetary consequences of decisions made in the game were, therefore, immediate and fairly substantial. As noted in the discussion of the face validity of CDG, participants appeared very highly involved in the game situation.

In discussing the current disappointing lack of demonstrated relations between real world and game behavior, Wrightsman et al. (1970) listed three properties which a game should have in order to increase its likelihood of showing a correspondence to a real world situation. The first was that there be opportunity for interaction. The CDG can be played in groups allowed to communicate freely. Half the groups in the research to be reported here had the chance to discuss the dilemma; another quarter of the subjects were allowed to interact but not to discuss the choices they would make. The second and third properties Wrightsman recommended were that there be the opportunity for improvisation and the opportunity to create irrelevant and distracting affect. Even in the non-communicating conditions to be reported here subjects were run in groups where these last two properties did exist. The version of CDG to be discussed here is, therefore, a game situation including the conditions under which one would be most optimistic of finding a correspondence with real world behavior.

#### Design Overview

Subjects were recruited from the local community by newspaper ads requesting groups of four friends and offering each participant the opportunity of winning as much as \$10.50. Subjects arrived in friendship groups (four friends). Each friendship group was instructed that they would be sharing their winnings and losses equally amongst themselves. The friendship group design was developed in order to create a situation in which subjects would face the possibility of losing real money. A negative payoff to one friend could cancel the

winnings of his friends. Each member of the friendship group was then directed to a separate room. Eight groups of four friends thus formed four decision groups composed of eight strangers. Each decision group then played one of eight versions of the CDG, after which subjects returned to their friendship groups where their original experimenter summed the earnings and losses for that group and paid each member one-fourth of that amount or zero if the sum for the group was below zero. The eight conditions for the CDG were composed by crossing four levels of communication with two types of payoff matrices--loss versus no loss. Payoff matrices were constructed according to the formal definition of the game (see page 16) with the following values:

$$c = \$2.50$$

$$d = \$9.50$$

$$\lambda = \$2.50$$

The no loss payoff matrix substituted zero wherever the subtraction of fines led to a negative value.

In each experimental session four decision groups were run. In two decision groups the payoff matrices went below zero. A participant in such a group knew that a choice to cooperate given that at least two other members did not cooperate could result in a negative payoff which would then be subtracted from any winnings his friends returned to his friendship group. In the other two decision groups in any given session the payoffs did not go below zero. In each session, each of four decision groups played under one of the following conditions:

No communication: Subjects worked individually on filler tasks under instructions not to communicate in any way.

Irrelevant communication: Subjects discussed an assigned topic under instructions not to discuss their decision task.

Communication: Subjects were allowed ten minutes to discuss their decision task but were not allowed to take votes or roll calls of intention.

Communication and vote: Subjects were allowed to discuss the decision task and were instructed that there would be a non-binding vote or roll call of intentions at the end of the discussion.

The complete design of the experiment thus consisted of eight cells as listed below:

Loss	No Loss
No Communication	No Communication
Irrelevant Communication	Irrelevant Communication
Communication	Communication
Communication and Vote	Communication and Vote

Figure 2. Design of Experiment I



## CHAPTER III

### EXPERIMENT I

#### Method

##### Subjects

Subjects were recruited from the local community by advertising in the local daily newspaper and the student newspaper. Ads requested groups of four friends and stated that each participant could win from 0 to \$10.50. Nine groups of four friends were scheduled for each session. Most sessions consisted of eight groups of four friends. If nine groups arrived, one group was paid \$2.00 each and an attempt was made to reschedule the group. When fewer than eight groups arrived, the size of decision groups (see Procedure) was reduced accordingly, unless four or fewer groups of friends arrived, in which case everyone was paid \$2.00 and rescheduled. In this way, an attempt was made to have each session consist of eight groups of four friends. Five sessions had eight groups of four friends. Three sessions had seven groups of four friends, and two sessions had five groups of four friends. Four decision groups were run each session yielding five groups in each of the eight cells of a two-way factorial design:  $A \times B$  (loss vs. no loss  $\times$  four levels of communication). A total of 283 subjects were run.



## Procedure

### Creating Decision Groups

As each group of four friends arrived for a session they were greeted by the receptionist and given identification tags. Each tag identified a subject by his friendship group number (1-8) and his decision group letter (A-H, representing eight experimental conditions. Four conditions were run at each session). Each subject was asked to put on an identification tag and wait in the lounge until everyone had arrived. When all of the friendship groups for a session had arrived an experimenter was assigned to each friendship group. One experimenter took each of the friendship groups to a different room where he explained the general nature of the experiment, made sure they said they were friends, and had each of the four friends sign a consent form. The four friends were told they would each be sent to a different room to participate in a decision task with a group of strangers (the decision group). The results of that decision would determine their winnings but the winnings and losses of each friend would be pooled and each would receive one-fourth of that amount, or zero if the total were negative. In this way, each subject could end up with as little as nothing or as much as \$10.50.

After obtaining consent forms from each of the four friends, the experimenter directed each friend to his different decision group. Before leaving the friendship group, subjects were reminded of where they were and asked to return to that room at the completion of the decision task to regroup with their friends and receive payment. Since

there were normally eight friendship groups, there were normally eight experimenters, two for each decision group.

#### CDG Played in Decision Groups

Loss vs. No Loss manipulation. When subjects were assembled in the four decision groups (each in a different room) they were each given a copy of a payoff matrix which was explained to them with examples. In each session, two decision groups received the Loss matrix and two groups received the No Loss matrix. The Loss matrix for eight-person groups is shown in Figure 3. The No Loss matrix substituted zero wherever the subtraction of fines led to a negative value. Matrices for five and seven-person groups were constructed in an identical manner with the bonus for defection reduced by \$4.50 and \$1.50 respectively. Payoff matrices were constructed in the following manner:

1.  $c = \$2.50$

Payoff for cooperation =  $c$  minus fine

2.  $d = \$9.50$  (for eight-person groups)

Payoff for defection =  $(c + d)$  minus fine

3.  $\lambda = \$2.50$

Collective fine for each choice of D =  $d + \lambda$

Each player's share of the fine =  $(d + \lambda)/N$

By mixing Loss and No Loss conditions in each session, it was hoped that most friendship groups would end up with positive totals when they reassembled.

Four levels of communication. In every condition, subjects were informed that each person would make his decision privately.

If you choose 0: you earn \$2.50 minus fine.

If you choose X: you earn \$2.50 plus \$9.50 minus fine.

Fine: \$1.50 charged to each person playing for every person who chooses X.

<u>Payoff to X</u>	<u>Number Choosing</u>		<u>Payoff to 0</u>
	<u>X</u>	<u>0</u>	
-0-	0	8	2.50
10.50	1	7	1.00
9.00	2	6	- .50
7.50	3	5	-2.00
6.00	4	4	-3.50
4.50	5	3	-5.00
3.00	6	2	-6.50
1.50	7	1	-8.00
0.00	8	0	-0-

Figure 3. Loss Payoff Matrix for Eight Person Groups

Subjects were told that after ten minutes, each would mark an X or an O in private. (Decisions were made on index cards which were inserted by the subjects into an envelope which they labeled with their ID information.) Members of decision groups never knew what decision had been made by any other member of their decision group. They did not even know the general outcome of their decision group until after they were separated into their friendship groups again. What went on during the ten minutes preceding the anonymous decision was determined by the level of communication of each decision group. Those levels were:

No communication: Subjects worked individually on a series of estimation tasks. (See Appendix A.) They were asked not to communicate in any way.

Irrelevant communication: Subjects worked as a group on a series of estimation tasks but were not allowed to discuss the decision they would be making at the end of the ten minutes.

Communication: Subjects discussed the decision they were about to make but they were forbidden from calling for a vote or a roll call of intentions.

Communication and vote: Subjects discussed the decision and were asked to take a vote or roll call of intentions at the end of the discussion. They were informed that the vote was non-binding in that all actual decisions would still be made privately and anonymously.

Experimenters waited until each subject had fully understood the matrix and the decision he would be asked to make before beginning the ten minute pre-decision period. Experimenters did not allow subjects

to answer one another's questions as it was felt that this would have constituted discussion of the problem.

At the end of the ten minute pre-decision period, all subjects were asked to mark their decision privately on their 3x5 card. On the back of this card they were asked to predict the decision each of the other members of the decision group would make. Experimenters collected the envelopes containing subjects' decisions and while one experimenter figured the outcome for the group, the other experimenter administered two questionnaire forms.

One questionnaire asked each subject to predict what decision each of his three friends (each in a different decision group) would make. Subjects had earlier made notes of the ID numbers of their friends so that they could be identified without using names. On this form each subject was also asked to rate how he, himself, and each of his friends usually reacts to such dilemmas. (See Appendix B for Questionnaire 1.) Subjects also filled out Behavior Checklist I (see Appendix B) which concerned real world behaviors and is described below. After filling out both questionnaires, subjects received a sealed envelope containing a card indicating the amount they had won or lost. Subjects were then asked to return to their friendship groups where their original experimenter collected their sealed envelopes and paid each friend one-fourth of his friendship group's total, or zero if the total was negative.

#### Behavior Checklist I

The Behavior Checklist was designed to cover three general types of real world behavior which might relate to cooperation or

defection in the game. The three scales were:

Anti-social behavior

Pro-social behavior

Commons dilemma behavior with the emphasis on personal efforts to avoid contributing to pollution.

Most items referred to the subject's actual behavior in the recent past. A few items asked what subjects would do in a given hypothetical situation. Scoring of the Checklist is described in Appendix B.

Fishbein and Ajzen (1974) have demonstrated that scales of self report of behavior can be created which meet the criteria for various types of attitude scales and that such scales correlate more highly with attitudes than do single items of behavior. Items from the Checklist were selected to create two parallel forms of a Thurstone Scale to see if these scales would correlate with game behavior. In addition, a scale was created from those items most highly correlated with game cooperation and most internally consistent. Experiment II reports cross validation of these three shorter scales.

### Results

The results of the experiment were first analyzed according to the proportion who defected. Since these findings are not the main concern of this research, they are briefly summarized here. The reader is referred to Dawes and McTavish (1975) for a complete report.

Whether a Loss or a No Loss payoff matrix was used had no effect. Over all forty groups, an average of 48.6 per cent of each group defected.

Communication had a very strong effect on percentage defecting; more than twice as many people defected when they were unable to discuss the decision they faced. There was no difference between not being able to communicate at all and being able to communicate but only on topics irrelevant to the decision. Within those conditions where the decision was discussed, whether or not a vote or a roll call of intentions was taken had no effect. Table I presents the proportion who defected in each condition.

Using this information concerning the base rates of defection in different conditions, it was possible to create an ordinal scale of cooperation. Because twice as many people defect in no communication or irrelevant communication conditions, those who cooperated in these conditions were assigned the highest cooperation score. Because most people cooperate in the communicating conditions, those who defected in these conditions were assigned the lowest cooperation score. Cooperation scores were assigned to each subject as follows:

Cooperation  
Score

4	Subject cooperated in a no communication condition
3	Subject cooperated in a communicating condition
2	Subject defected in a no communication condition
1	Subject defected in a communication condition

The cooperation score a subject received in the game was expected to relate to his self report of anti-social, pro-social and real world commons dilemma behavior. The correlations between cooperation and

TABLE I

PROPORTION DEFECTING: FIVE GROUPS PER CELL

	<u>No Communication</u> N	<u>Irrelevant Communication</u> I	<u>Unrestricted Communication</u> C	<u>Communication Plus Vote</u> C+V
<u>Loss</u>	.73	.65	.26	.16
<u>No Loss</u>	.67	.70	.30	.42
<u>Analysis of Variance</u>				
	S.S.	Df	M.S.	F
<u>Loss (L)</u>	.12	1	.12	.35
<u>Communi- cation (C)</u>	9.52	3	3.17	9.36 (p < .001)
<u>LC</u>	.75	3	.25	.74
<u>Error</u>	10.85	32	.34	



each of the three scales and a composite of all three scales are reported in Table II. Scale consistency information is reported in Appendix B.

It was also expected that scale scores would correlate with how the subjects and their three friends rated the subject's general tendency to react to commons dilemma situations. Each subject was rated by himself and each of his three friends on the following nine-point scale:

For yourself and each of your three friends here today, please indicate how you think each person generally reacts to situations in which one must choose between individual gain at no cost to one's self but with costs spread over other people, or a contribution to the good of his group at some cost to himself and no cost to others.

Circle a number between 1-9

1 2 3 4 5 6 7 8 9

Individual  
gain

Group gain

Correlations of these ratings with game cooperation and each of the Behavior Checklist scales are also reported in Table II.

Those subjects who reported more cooperation in large scale social dilemmas (commons scale) were more cooperative in the game, and were judged to be more cooperative by their friends and themselves. The APC combined score correlated as expected with game cooperation and self judgment but not with friends' judgments. Friends' judgments, however, did not correlate significantly with game cooperation or self judgment of general tendency to cooperate. Self judgment was the best predictor of game cooperation.

TABLE II

CORRELATIONS OF GAME COOPERATION, AND SELF AND FRIENDS'  
JUDGMENTS OF COOPERATIVENESS WITH EACH BEHAVIOR  
CHECKLIST SCALE  
(For All Subjects N=283)

	<u>Game Cooperation</u>	<u>Self Judgment</u>	<u>Friends' Judgments</u>
<u>Behavior Checklist</u>			
Anti-Social Scale	-.10	-.05	-.05
Pro-Social Scale	.07	.10	.03
Commons Scale	.15*	.18**	.14*
APC Combined Score	.15*	.15*	.10
<u>Game Cooperation</u>	1.00	.39***	.07
<u>Self Judgment</u>	.39***	1.00	.05
<u>Friends' Judgment</u>	.07	.05	1.00

\*  $p < .05$  two-tailed

\*\*  $p < .01$  two-tailed

\*\*\*  $p < .001$  two-tailed

As mentioned earlier (see page 21) the opportunity to interact, to improvise and to create distracting affect may increase the likelihood that game behavior will be related to real world behavior. These conditions were most strongly operating in the two conditions where subjects were allowed to communicate about the decision. Table III presents the results for communicating conditions separated from no communication and irrelevant communication.

Thurstone scales. Each of the ninety checklist items was judged for extremity by 15 expert judges (faculty members and doctoral students in psychology). Two forms of a 22-item Thurstone scale were created. All items had Q values of 2.0 or less. The scales and their development are described in more detail in Appendix C. The correlation of FORM 1 with FORM 2 was .71 ( $N = 283$ ). The relationship between these two scales and game cooperation and judgments of cooperativeness are presented in Table IV.

FORM 3--best predicting items. Another short scale was created by choosing those items which best predicted game cooperation and were also internally consistent. The scale consisted of 23 items (see FORM 3, Appendix D). Like the original checklist, items were of three general types:

Anti-social: six items with an average item-scale correlation of .56.

Pro-social: six items with an average item-scale correlation of .55.

Commons: eleven items with an average item-scale correlation of .44.

TABLE III

CORRELATIONS OF GAME COOPERATION AND SELF AND FRIENDS'  
JUDGMENTS OF GENERAL TENDENCY TO COOPERATE IN DILEMMAS  
WITH EACH BEHAVIOR CHECKLIST SCALE

	<u>Communication</u> N = 142			<u>No Communication &amp; Irrelevant Comm.</u> N = 141		
	<u>Game Coop</u>	<u>Self Judgment</u>	<u>Friends' Judgment</u>	<u>Game Coop</u>	<u>Self Judgment</u>	<u>Friends' Judgment</u>
<u>Behavior Checklist</u>						
Anti-Social	-.20*	-.13	-.06	.03	.05	-.03
Pro-Social	.10	.09	.12	.03	.11	-.07
Commons	.22**	.18*	.13	.07	.20*	.13
APC Combined	.24**	.19*	.14	.04	.13	.05
<u>Game Cooperation</u>	1.00	.53***	-.10	1.00	.25**	.23**
<u>Self Judgment</u>	.53***	1.00	-.01	.25**	1.00	.12
<u>Friends' Judgments</u>	-.10	-.01	1.00	.23**	.12	1.00

\*p &lt; .05

\*\*p &lt; .01 (two-tailed)

\*\*\*p &lt; .001 (two-tailed)

TABLE IV

CORRELATIONS OF GAME COOPERATION, SELF AND FRIENDS' JUDGMENTS OF COOPERATIVENESS, AND PROPORTION OF DEFECTIONS PREDICTED BY THE SUBJECT WITH TWO THURSTONE SCALES OF COOPERATION IN DILEMMAS AND WITH EACH SUBSCALE OF BEHAVIOR CHECKLIST FORM 3  
(For All Subjects N=283)

	<u>Game Cooperation</u>	<u>Self Judgment</u>	<u>Friends' Judgment</u>	<u>Proportion Predicted to Defect</u>
<u>Behavior Checklist Form 3<sup>c</sup></u>	<u>N=283</u>	<u>N=283</u>	<u>N=283</u>	<u>N=264<sup>a</sup></u>
Anti-Social	-.22	-.09	.01	-.02
Pro-Social	.16	.09	.07	.05
Commons	.21	.18	.05	-.03
APC Combined	.29	.18	.05	.00
<u>Thurstone Form 1</u>	.03	.08	.07	.04
<u>Thurstone Form 2</u>	.02	.05	.05	-.01
<u>Proportion Predicted to Defect<sup>a</sup></u>	-.61 <sup>b*</sup>	-.21 <sup>*</sup>	.05	1.00

<sup>a</sup>Not all subjects made the requested predictions. N=264.

<sup>b</sup>Correlation not based on 4 point cooperation scale.  
Defection = 0. Cooperation = 1.

<sup>c</sup>In Tables IV, V, and VI, Significance Levels for correlations with Form 3 are not reported because items were chosen post hoc partly on the basis of their correlation with game cooperation.

\*  $p < .001$  (two-tailed).

Eleven of the items were worded positively and twelve were worded negatively. A fourth subscale was created by reversing the scoring of the anti-social subscale and combining all three subscales. The correlation of these four subscales with game cooperation and self and friends' judgments is reported in Table IV. Significance levels are not reported for FORM 3 because items were selected post hoc partly on the basis of their correlations with game cooperation.

Table IV also reports correlations between a subject's game cooperation and self and friends' judgments of his general tendency to cooperate in dilemmas, with the amount of defection which the subject predicted for his group (not including himself). It was expected that a subject's predictions about other people would relate to his own cooperativeness, both in the game and in the large scale social dilemma situations described in the checklist items. Subjects with a less cooperative orientation themselves were expected to predict more defection on the part of other group members.

The amount of defection a subject predicted shows a strong negative correlation with his game cooperation ( $r = -.61$ ). This correlation was figured on a two-point scale of cooperation rather than the four point scale used for all other correlations of game cooperation. The four point scale assigns a score of four only to those subjects who cooperated in a condition in which most subjects defected. Thus, if predicted defection is at all veridical, the use of the four point cooperation scale for this correlation would obscure the real relationship between how much defection a subject expects from other people and his own tendency to defect.

Tables V and VI present the correlations of the four subscales of FORM 3 with cooperation and self and friends' judgments separated by the two main types of communication condition.

### Discussion

In interpreting the statistical significance of these correlations, it should be kept in mind that the correlations are not independent of one another and the significance level underestimates the true probability of Type I errors.

The results of this experiment are not encouraging for those who would like to use the CDG as an analogue of real world commons dilemmas. The original 90-item Behavior Checklist I sampled a wide variety of anti-social, pro-social and commons dilemma behaviors. For the sample as a whole, subjects' APC scores (representing a combination of the three types of behaviors in real life) account for only 2% of the variance of their game cooperation. Thus, while the APC-game cooperation correlation of .15 is statistically significant ( $N = 283$ ) the "significance" of the relationship between game and real life behavior is highly questionable.

Two attempts to refine the measurement of real world behaviors were also disappointing as far as increasing the ability to predict game cooperation is concerned. Two parallel forms of a Thurstone scale of real world commons behavior (FORM 1 and FORM 2) were developed. For the sample as a whole, neither form was significantly related to game cooperation.



TABLE V

CORRELATIONS OF GAME COOPERATION, SELF AND FRIENDS' JUDGMENTS OF COOPERATIVENESS, AND PROPORTION OF DEFECTIONS PREDICTED BY THE SUBJECT WITH TWO THURSTONE SCALES OF COOPERATION IN DILEMMAS AND WITH EACH SUBSCALE OF BEHAVIOR CHECKLIST FORM 3  
(For Communication Conditions N=142)

	Game Cooperation	Self Judgment	Friends' Judgment	Proportion Predicted to Defect
<u>Behavior Checklist Form 3</u>	N=142	N=142	N=142	N=130 <sup>a</sup>
Anti-Social	-.29	-.20	.04	.13
Pro-Social	.21	.19	.11	.02
Commons	.25	.24	.02	-.03
APC Combined	.36	.30	.04	-.05
<u>Thurstone Form 1</u>	.17*	.13	.08	.03
<u>Thurstone Form 2</u>	.08	.01	.06	.07
<u>Proportion Predicted to Defect<sup>a</sup></u>	-.56**	-.40**	.04	1.00

<sup>a</sup>Not all subjects made the requested predictions. N=130.

\*  $p < .05$  (two-tailed).

\*\*  $p < .001$  (two-tailed).

TABLE VI

CORRELATIONS OF GAME COOPERATION, SELF AND FRIENDS' JUDGMENTS OF COOPERATIVENESS, AND PROPORTION PREDICTED TO DEFECT BY THE SUBJECT, WITH TWO THURSTONE SCALES OF COOPERATION IN DILEMMAS AND WITH EACH SUBSCALE OF BEHAVIOR CHECKLIST FORM 3  
(For No Communication or Irrelevant Communication Conditions N=141)

	Game Coop	Self Judgment	Friends' Judgment	Proportion Predicted to Defect
<u>Behavior Checklist Form 3</u>	N=141	N=141	N=141	N=134 <sup>a</sup>
Anti-Social	-.17	.01	.01	-.01
Pro-Social	.12	.00	.05	.13
Commons	.16	.10	.09	.00
APC Combined	.24	.06	.06	.03
<u>Thurstone Form 1</u>	-.07	.04	.06	.04
<u>Thurstone Form 2</u>	-.01	.08	.05	-.01
<u>Proportion Predicted to Defect<sup>a</sup></u>	-.43*	-.08	-.08	1.00

<sup>a</sup>Not all subjects made the requested predictions. N=134.

\*p < .001 (two-tailed).

A third scale was created (FORM 3) by extracting items which were most internally consistent and most highly correlated with game cooperation (when considered individually). Items representing each of the three types of real world behavior were extracted from the original scale. The APC subscale of FORM 3 only accounted for 8% of the variance of game cooperation for all subjects. ( $r = .29$ )

The communicating conditions of this experiment were believed to represent those conditions most likely to reveal a relationship between real world and game behavior. In every case, the correlations between real and game behavior are higher in communicating than non-communicating conditions. Even so, the highest correlation between real and game behavior, subscale APC of FORM 3 and game cooperation ( $r = .36$ ) shows that even in communicating conditions real world behavior only accounts for 13% of the variance of game cooperation.

The two best predictors of a subject's game cooperation were his self judgment of his general tendency to cooperate in dilemmas, and his prediction of how many other people in the group would defect.

Given the possibilities for capitalization on chance involved in extracting items from the original 90-item Behavior Checklist I, the correlations reported here, even though they indicate very little correspondence between game and real behavior, are likely to over-estimate the true relationship between game and real behavior. Experiment II was run to cross validate the three new measurements of real world behavior. The results of Experiment II should give some indication of to what degree those relationships which did appear in Experiment I represent mere capitalization on chance.

## CHAPTER IV

### EXPERIMENT II

#### Method

##### Design

Groups of eight strangers played a one trial CDG with a No Loss payoff matrix. Each group was observed through a one-way mirror by from five to eight observers. Half the groups discussed their decision task for ten minutes before making private decisions. The other half discussed an irrelevant topic (see Estimation Tasks in Appendix A) for ten minutes prior to their private decisions. The design was thus a simple one way ANOVA with two levels of communication: communication and irrelevant communication. There were ten groups in each condition.

##### Subjects and Observers

Subjects were recruited from the local community by advertising in the local daily newspaper and in the student newspaper. Ads stated that each participant could win from zero to \$10.50. A total of 309 people participated. As in Experiment 1, students, young people and unemployed people were probably over-represented in the sample. Friends were asked not to sign up for the same time.

As part of another research project, decision groups were to be videotaped and also observed by other naive subjects through one-way

mirrors. In order to keep the number of participants in the decision group constant, the number of observers was allowed to vary from five to eight. Assignment to be an observer or a participant was made randomly after all subjects had arrived and signed consent forms concerning videotaping and payment. If any friends were present they were both made observers.

### Procedure

Observers. After random assignment to be observers, observers watched participants enter an adjacent room which they could observe through a one-way mirror and hear over loudspeakers. Participants could not see or hear observers but were aware of the fact that they were being observed. Observers were then instructed concerning the nature of the decision participants would be asked to make. Observers were told that after observing the ten minute discussion they would be asked to predict what decision each participant had made. Observers were then left alone to watch the experimenter give instructions to the decision participants. After the participants had made their decision the experimenter returned to the observers to collect their predictions and to administer the self judgment scale and Behavior Checklist II to the observers. Observers were then paid \$2.00 and sent home.

Participants. Experimenters explained the general nature of experiment and the fact that the group would be observed and taped, but that their decisions would remain anonymous. The experimenter then gave each subject a copy of the payoff matrix shown in Figure 4.

If you choose 0: you earn \$2.50 minus fine.

If you choose X: you earn \$2.50 plus \$9.50 minus fine.

Fine: \$1.50 charged to each person playing for every person who chooses X.

<u>Payoff to X</u>	<u>Number Choosing</u>		<u>Payoff to 0</u>
	<u>X</u>	<u>0</u>	
-0-	0	8	2.50
10.50	1	7	1.00
9.00	2	6	-0-
7.50	3	5	-0-
6.00	4	4	-0-
4.50	5	3	-0-
3.00	6	2	-0-
1.50	7	1	-0-
-0-	8	0	-0-

Figure 4. No Loss Payoff Matrix for Eight Person Group

When everyone understood the matrix the ten minute pre-decision discussion period began. In the communication condition, subjects were told they would have ten minutes to discuss the decision before making their private decision. In the irrelevant communication condition, they were told they would have ten minutes to discuss an assigned topic but that they must not discuss the decision they would be making privately. In both conditions, they were informed that they would be paid and dismissed privately so that no one but the experimenter would know their individual decision. At the end of the ten minute discussion, all subjects were asked to make their decision privately on a sheet provided and put it in an envelope which they marked with their ID number. The experimenter collected the envelopes and distributed two questionnaires to each subject. The first questionnaire asked about their general reactions to commons dilemma situations (see Questionnaire I, Appendix D) and the other questionnaire was Behavior Checklist II, which is described below. As subjects finished the questionnaires, they were removed from the group one at a time to be paid and dismissed from an adjoining room.

Behavior Checklist II. This questionnaire consisted of 52 items selected from the original 90-item Behavior Checklist I. Forty-four of the items form two non-overlapping forms of a Thurstone Scale of Commons Dilemma behavior (see Appendix C). A third scale, FORM 3, was created by choosing 23 items from the original 90-item Checklist I which correlated most highly with game cooperation and were also reasonably internally consistent (see Appendix D). Fifteen of the 23 items also met the criteria for the Thurstone scales.



### Hypothesis

It was hypothesized that cooperation in the CDG would correlate with self report of cooperative behavior in real world dilemmas as measured by the three scales described above. It was also hypothesized that the observers' self report of cooperative behavior in social dilemmas would correlate positively with their self judgments of general tendency to cooperate and negatively with the amount of defection they predicted in the decision group.

### Results

#### Participants

The results of Experiment II replicate the findings from Experiment I that communication reduces defection. Overall, the results of Experiment I concerning correlations of the three measures of real world behavior with game behavior did not cross validate in Experiment II.

Table VII shows the mean number of subjects defecting in the two conditions. The effectiveness of communication in reducing defection was replicated. More than twice as many subjects defected when their discussion was limited to a topic irrelevant to the decision they were facing.

Cooperation scores were assigned to each subject in the same manner as in Experiment I. Each subject made a self judgment of his general tendency to cooperate in real world dilemmas on a nine point scale. In addition, each subject predicted the decision of every other

TABLE VII  
MEAN NUMBER DEFECTING: TEN GROUPS PER CELL

<u>Irrelevant Communication</u>	<u>Communication</u>			
6.1	2.5			
<u>Analysis of Variance</u>				
	S.S.	Df	M.S.	F
<u>Between</u>	64.8	1	64.8	31.19 (p < .0001)
<u>Within</u>	37.4	18	2.08	
<u>Total</u>	102.2	19		

person in his group. Cross validation of the relationship between game cooperation and the three measures of real world behavior developed in Experiment I are presented in Table VIII.

The correlations between game cooperation and each of the four subscales of Behavior Checklist FORM 3 are not significant and two are in the direction opposite predictions. The correlations between game cooperation and the two Thurstone scales are not significant and one is in the direction opposite predictions.

It was also expected that scale scores would correlate with subjects' self judgments of their general tendency to react cooperatively to social dilemmas. Table VIII shows that only Thurstone FORM 1 was significantly correlated with self judgment.

Cooperation in the game is correlated  $-.55$  with number of defections predicted. Predictions do not include the subject predicting his own behavior. This correlation was figured on a two-point scale of cooperation rather than the four point scale used for all other correlations with game cooperation. The four point scale assigns a score of four only to those subjects who cooperated in a condition in which most subjects defected. Thus, if predicted defection is at all veridical, the use of the four point scale of cooperation for this correlation would obscure the real relationship between how much defection the subject expects from other people and his own tendency to defect or cooperate. The amount of defection predicted also correlates negatively with a subject's self judgment of his own cooperativeness. The three measures of behavior in large scale social dilemmas, FORM 1, FORM 2, and FORM 3, do not correlate with amount of defection predicted.

TABLE VIII

CORRELATIONS OF GAME COOPERATION, SELF JUDGMENT OF GENERAL TENDENCY TO COOPERATE IN DILEMMAS, AND NUMBER OF DEFECTIONS PREDICTED BY THE SUBJECT, WITH EACH BEHAVIOR CHECKLIST SCALE AND THURSTONE FORM 1, AND THURSTONE FORM 2

<u>For All Participants</u>			
	<u>Game Cooperation N=160</u>	<u>Self Judgment N=142<sup>b</sup></u>	<u>Predicted Defections N=160</u>
<u>Behavior Checklist Form 3</u>			
Anti-Social Scale	-.01	-.10	-.09
Pro-Social Scale	-.12	.12	-.08
Commons Scale	.06	.05	-.13
APC Combined Score	-.02	.13	.05
<u>Thurstone Form 1</u>	.03	.30***	-.01
<u>Thurstone Form 2</u>	-.09	.13	-.11
<u>Game Cooperation</u>	1.00	.25**	-.55*** <sup>a</sup>
<u>Self Judgment</u>	.25**	1.00	-.20*
<u>Predicted Defections</u>	-.55*** <sup>a</sup>	-.20*	1.00

<sup>a</sup>Correlation not based on 4 point cooperation scale.  
Defection = 0. Cooperation = 1.

<sup>b</sup>Some subjects did not make a self judgment of general tendency to cooperate in dilemmas.

\*  $p < .05$  (two-tailed).

\*\*  $p < .01$  (two-tailed).

\*\*\*  $p < .0005$

Tables IX and X show the same correlations figured separately by condition. Table IX shows that in the communication condition only Thurstone FORM 1 is significantly correlated with game cooperation. The correlation of the prosocial scale and game cooperation is in the direction opposite predictions. Table X shows that in the irrelevant communication condition eight of the correlations are in the direction opposite predictions. Only the prosocial scale is significantly correlated in the predicted direction with self judgment.

Tables VIII, IX and X do show that self judgment is positively correlated with game cooperation and that predicted defections are negatively correlated with game cooperation and self judgment.

#### Observers

Table XI shows the correlations of FORM 1, FORM 2 and FORM 3 with self judgments of cooperativeness and number of defections predicted by observers. The commons scale of FORM 3 and Thurstone FORM 1 are positively correlated with self judgments of cooperativeness. Predicted defections are negatively correlated with self judgment of cooperativeness.

Table XII shows the results for observers separated by which condition they observed. When separated by condition six of the correlations are in the direction opposite predictions.

TABLE IX

CORRELATIONS OF GAME COOPERATION, SELF JUDGMENT OF GENERAL  
TENDENCY TO COOPERATE IN DILEMMAS, AND NUMBER OF DEFECTIONS  
PREDICTED BY THE SUBJECT WITH EACH BEHAVIOR CHECKLIST  
SCALE AND THURSTONE FORM 1 AND THURSTONE FORM 2  
(Communication N=80)

	Game Cooperation N=80	Self Judgment N=70 <sup>a</sup>	Predicted Defections N=80
<u>Behavior Checklist Form 3</u>			
Anti-Social	-.12	-.23	-.07
Pro-Social	-.23 <sup>b*</sup>	-.10	-.03
Commons	.13	.02	-.14
APC Combined	.03	.22	-.06
<u>Thurstone Form 1</u>	.18	.46 <sup>***</sup>	-.04
<u>Thurstone Form 2</u>	.06	.08	.03
<u>Game Cooperation</u>	1.00	.24 <sup>*</sup>	-.35 <sup>**</sup>
<u>Self Judgment</u>	.24 <sup>*</sup>	1.00	.16
<u>Predicted Defections</u>	-.35 <sup>**</sup>	.16	1.00

<sup>a</sup>Some subjects did not make a self judgment.

<sup>b</sup>Opposite predicted direction.

\*  $p < .05$  (two-tailed).

\*\*  $p < .01$  (two-tailed).

\*\*\*  $p < .0001$  (two-tailed).

TABLE X

CORRELATIONS OF GAME COOPERATION, SELF JUDGMENT OF GENERAL  
TENDENCY TO COOPERATE IN DILEMMAS, AND NUMBER OF DEFECTIONS  
PREDICTED BY THE SUBJECT WITH EACH BEHAVIOR CHECKLIST  
SCALE AND THURSTONE FORM 1 AND THURSTONE FORM 2  
(Irrelevant Communication N=80)

	Game Cooperation N=80	Self Judgment N=72 <sup>a</sup>	Predicted Defections N=80
<u>Behavior Checklist Form 3</u>			
Anti-Social	.13	.02	-.20
Pro-Social	.01	.34**	-.07
Commons	.01	.05	-.08
APC Combined	-.07	.04	.13
<u>Thurstone Form 1</u>	-.11	.17	.05
<u>Thurstone Form 2</u>	-.28* <sup>b</sup>	.15	-.12
<u>Game Cooperation</u>	1.00	.29*	-.42***
<u>Self Judgment</u>	.29**	1.00	-.33**
<u>Predicted Defection</u>	-.42***	-.33**	1.00

<sup>a</sup>Not all subjects made the requested self judgment.

<sup>b</sup>Opposite predicted direction.

\*  $p < .05$  (two-tailed).

\*\*  $p < .01$  (two-tailed).

\*\*\*  $p < .001$  (two-tailed).



TABLE XI

CORRELATIONS OF SELF JUDGMENT OF COOPERATIVENESS AND NUMBER OF  
 DEFECTIONS PREDICTED WITH TWO THURSTONE SCALES OF COOPERATION  
 IN DILEMMAS AND THE FOUR SUBSCALES OF BEHAVIOR  
 CHECKLIST FORM 3  
 (Observers)

	Self Judgments N=125 <sup>a</sup>	Predicted Defections N=149
<u>Behavior Checklist Form 3</u>		
Anti-Social	.05	.02
Pro-Social	.14	-.06
Commons	.30 <sup>**</sup>	-.04
APC Combined	.04	-.01
<u>Thurstone Form 1</u>	.31 <sup>**</sup>	.04
<u>Thurstone Form 2</u>	.03	.06
<u>Self Judgment</u>	1.00	-.18 <sup>*</sup>
<u>Predicted Defections</u>	-.18 <sup>*</sup>	1.00

<sup>a</sup>Not all subjects made the requested self judgment.

<sup>\*</sup>p < .05 (two-tailed).

<sup>\*\*</sup>p < .005 (two-tailed).

TABLE XII

CORRELATIONS OF SELF JUDGMENT OF COOPERATIVENESS AND NUMBER OF  
DEFLECTIONS PREDICTED WITH TWO THURSTONE SCALES OF COOPERATION  
IN DILEMMAS AND THE FOUR SUBSCALES OF BEHAVIOR  
CHECKLIST FORM 3  
(Observers by Condition)

	<u>Communication</u>		<u>Irrelevant Communication</u>	
	<u>Self Judgment N=65</u>	<u>Predicted Deflections N=73</u>	<u>Self Judgment N=60</u>	<u>Predicted Deflections N=75</u>
<u>Behavior Checklist Form 3</u>				
Anti-Social	.24 <sup>*a</sup>	-.15	-.16	.07
Pro-Social	.11	-.10	.19	.00
Commons	.24	.06	.35 <sup>**</sup>	-.06
APC Combined	-.20	.14	.30 <sup>*</sup>	-.03
<u>Thurstone Form 1</u>	.26 <sup>*</sup>	.09	.36 <sup>**</sup>	.03
<u>Thurstone Form 2</u>	.04	.10	.03	.06
<u>Self Judgment</u>	1.00	-.15	1.00	-.16
<u>Predicted Deflections</u>	-.15	1.00	-.16	1.00

<sup>a</sup>Opposite predicted direction.

<sup>\*</sup>p < .05 (two-tailed).

<sup>\*\*</sup>p < .01 (two-tailed).

## CHAPTER V

## DISCUSSION

External Event Validity of the Commons Dilemma GameThree Measures of Real World Behavior

The three measures of real world behavior in large scale social dilemmas, Thurstone FORM 1, Thurstone FORM 2, and Behavior Checklist FORM 3, accounted for very little of the variance of game cooperation in Experiment I and did not cross validate in Experiment II. The results suggest that an individual's cooperation or defection in the game is not related to his tendency to cooperate or defect in large scale social dilemmas.

Fishbein and Ajzen (1974) showed that behavioral items could be scaled in accordance with various attitude scaling techniques and that such multiple-item scales of behavior correlated more highly with attitude scales than did single behaviors. In Experiments I and II two Thurstone scales of cooperative behavior in large scale social dilemmas were developed. The two Thurstone scales did not correlate with game cooperation. Fishbein and Ajzen used their results to argue against the use of single item behavioral criteria in the study of the attitude-behavior relationship. The present research was concerned with the relationship between behavior in the Commons Dilemma game and behavior in large scale social dilemmas. The Thurstone scales provided multiple-item criteria for behavior in large scale social dilemmas, but game cooperation was necessarily limited to a one item behavioral

criterion. The Commons Dilemma game, as presently developed does not lend itself to repeated plays. Post experimental comments of subjects suggest that behavior in repeated plays would be greatly affected by the outcomes of earlier trials. Results suggest that a one trial Commons Dilemma game does not have the event validity required to be accepted as a tool for the development of theories at the level of individual decision making in commons dilemma situations.

### Internal Variable Parameter Validity of the Commons Dilemma Game

#### Effects of Communication

In both Experiment I and Experiment II, the opportunity to communicate about the dilemma faced by the group had a very strong effect. Communication reduced the amount of defection by about fifty per cent in both experiments, and the actual proportions of defection in the two experiments were almost identical. These results suggest a high internal variable parameter validity for communication in the game. If field research could demonstrate similar communication effects in large scale social dilemmas, the Commons Dilemma game might still prove useful in the development of theories concerning cooperation at a group rather than an individual level.

#### Friends' Judgments of Cooperativeness, Self Judgment of Cooperativeness, and Predictions About Other People

In Experiment I, three friends made judgments of each subject's general tendency to cooperate in social dilemmas on a nine point scale.

Each subject also made such a judgment about himself. Friends' judgments did not correlate with game cooperation, scales or real world behavior, or the self judgments of the subjects.

Self judgments of cooperativeness in social dilemmas correlated positively with game cooperation in both experiments. The self judgment was designed to elicit a subject's judgment of his general tendency to cooperate in large scale dilemmas. Had subjects responded to the item in that way, the positive correlations and their cross-validation in Experiment II might be taken as evidence of external event validity. However, subjects filled out the self judgments shortly after playing the Commons Dilemma game. Self judgments were not consistently correlated with the three measures of behavior in large scale social dilemmas. Self judgments of participants may have been made largely on the basis of their recent behavior in the game. A conservative interpretation of these results suggests support for internal but not external validity of the game.

Subjects in both Experiment I and Experiment II were asked to predict the decision of each other group member. In both experiments those subjects who themselves defected, predicted much more defection on the part of other people. These results would be evidence of external event validity on an individual level if predicted defections reflected subjects' basic assumptions about other people and influenced their choices to defect or cooperate in the game and in large scale social dilemmas. However, predicted defections are not consistently correlated with the three measures of cooperation in large scale dilemmas. The cross validated negative correlation between predicted defections and decision

to cooperate is thus interpreted as further evidence of internal variable parameter consistency in the Commons Dilemma game. That is, a decision to cooperate in the game has a consistent, predictable relationship to a subject's perception of the other people in his group. The effect was found within as well as between groups. Table XIII presents the correlations between the amount of defection subjects in Experiment II expected from other people and their own decision to cooperate, calculated separately for each of the twenty groups. The finding that defectors predict more defection from other people is similar to the findings of Kelley and Stahelski (1970) for the Prisoner's Dilemma game. Current research is exploring the question of to what extent predictions about others determine one's own decision and to what extent one's own decision may lead to rationalizations that might affect one's predictions (Dawes and McTavish, in preparation).

#### Summary

In summary, evidence for external event validity at an individual level was not found. However, several findings suggest high internal variable parameter validity. Further research showing similar effects for the same variables in the reference system is called for to test the external variable parameter validity of the game for hypothesis and theory development at a group level.

TABLE XIII

CORRELATIONS OF NUMBER OF DEFECTIONS  
PREDICTED BY THE SUBJECT WITH THE  
SUBJECT'S DECISION TO COOPERATE

Within Group Correlations  
N = 8 for Each Correlation

Group Number	Correlation
1	.49
2	-.49
3	-.91
4	-.75
5	-.44
6	-.33
7	-.64
8	.47
9	-.25
10	-.29
11	-.38
12	-.22
13	-.38
14	All subjects defected
15	All subjects cooperated
16	-.54
17	-.72
18	-.34
19	.28
20	-.63



**APPENDICES**

## APPENDIX A

Estimation Tasks

The following estimation tasks were used in Experiment I in the No Communication Condition and in the Irrelevant Communication Condition. In the former subjects worked individually on the task and in the latter they made their estimations as a group. The same tasks were used in the Irrelevant Communication Condition of Experiment II.

Please estimate the total number of people in the US whose incomes fall into each of the following categories.

_____	\$1000 or less
_____	\$1001 - \$3000
_____	\$3001 - \$5000
_____	\$5001 - \$8000
_____	\$8001 - \$10,000
_____	\$10,001 - \$15,000
_____	\$15,001 - \$20,000
_____	\$20,001 - \$25,000
_____	\$25,001 - \$30,000
_____	\$30,001 - \$40,000
_____	\$40,001 - \$50,000
_____	\$50,001 - \$60,000
_____	\$60,001 - \$100,000
_____	\$100,001 - \$1,000,000
_____	\$1,000,001 or above

Please estimate the total number of people in the US whose years of formal education reach but do not exceed the following levels.

_____	No formal education
_____	3 years or less (but not zero)
_____	More than 3 years but 6th grade not completed
_____	6th grade completed
_____	7th grade completed
_____	8th grade completed
_____	9th grade completed
_____	10th grade completed
_____	11th grade completed
_____	High School graduate
_____	1 year college, no degree
_____	2 years college, no degree
_____	2 years college, associate degree
_____	3 years college, no degree
_____	4 years college, no degree
_____	4 years college, bachelor's degree
_____	some graduate work, no degree
_____	Master's degree
_____	Master's degree plus added education
_____	Ph.D.
_____	Other graduate education completed (law, medicine, etc.)

Please estimate the total number of people in the US who fall into each of the following age categories.

_____	0 - 5
_____	6 - 10
_____	11 - 15
_____	16 - 20
_____	21 - 25
_____	26 - 30
_____	31 - 35
_____	36 - 40
_____	41 - 45
_____	46 - 50
_____	51 - 55
_____	56 - 60
_____	61 - 65
_____	66 - 70
_____	71 - 75
_____	76 - 80
_____	80 and above

Please estimate the total number of people in Eugene whose incomes fall into each of the following categories.

_____	\$1000 or less
_____	\$1001 - \$3000
_____	\$3001 - \$5000
_____	\$5001 - \$8000
_____	\$8001 - \$10,000
_____	\$10,001 - \$15,000
_____	\$15,001 - \$20,000
_____	\$20,001 - \$25,000
_____	\$25,001 - \$30,000
_____	\$30,001 - \$40,000
_____	\$40,001 - \$50,000
_____	\$50,001 - \$60,000
_____	\$60,001 - \$100,000
_____	\$100,001 - \$1,000,000
_____	\$1,000,001 or above

Please estimate the total number of people in Eugene whose years of formal education reach but do not exceed the following levels.

_____	No formal education
_____	3 years or less (but not zero)
_____	More than 3 years but 6th grade not completed
_____	6th grade completed
_____	7th grade completed
_____	8th grade completed
_____	9th grade completed
_____	10th grade completed
_____	11th grade completed
_____	High School graduate
_____	1 year college, no degree
_____	2 years college, no degree
_____	2 years college, associate degree
_____	3 years college, no degree
_____	4 years college, no degree
_____	4 years college, bachelor's degree
_____	some graduate work, no degree
_____	Master's degree
_____	Master's degree plus added education
_____	Ph.D.
_____	Other graduate education completed (law, medicine, etc.)



Please estimate the total number of people in Eugene who fall into each of the following age categories.

_____	0 - 5
_____	6 - 10
_____	11 - 15
_____	16 - 20
_____	21 - 25
_____	26 - 30
_____	31 - 35
_____	36 - 40
_____	41 - 45
_____	46 - 50
_____	51 - 55
_____	56 - 60
_____	61 - 65
_____	66 - 70
_____	71 - 75
_____	76 - 80
_____	80 and above

## APPENDIX B

Experiment IQuestionnaire 1 and Behavior Checklist I

Questionnaire 1 and Behavior Checklist I were administered to all subjects in Experiment I after their decision task was completed, but before they returned to their friendship groups.

The following information will be treated as completed confidential.

70

For each of your three friends here today, indicate whether you believe he/she chose an X or an O in her/his decision task. Then indicate your confidence level concerning your judgment, with a number from 50 to 100. 100 indicates complete confidence. If you're just guessing the probability you are right is 50-50, and you should put 50.

Please refer to the back of your white index card if you do not recall your friends' ID numbers.

Friends' ID Number (e.g., 7A, 7C, 7D)	X or O chosen by her or him	Your confidence 0 - 100
--	--------------------------------	----------------------------

_____	_____	_____
_____	_____	_____
_____	_____	_____

For yourself and each of your three friends here today, please indicate how you think each person generally reacts to situations in which one must choose between individual gain at no cost to one's self but with costs spread over other people, or a contribution to the good of his group at some cost to himself and no cost to others.

	<u>ID#</u>	Circle a number between 1 - 9								
Yourself	_____	1	2	3	4	5	6	7	8	9
		individual gain						group gain		
Friend	_____	1	2	3	4	5	6	7	8	9
Friend	_____	1	2	3	4	5	6	7	8	9
Friend	_____	1	2	3	4	5	6	7	8	9

## Behavior Checklist.

INSTRUCTIONS: All answers to this questionnaire will be treated as strictly confidential; Do not put your name on the answer sheet. We wish to have no way to connect names with answers. In the space asking for your name, please write your identification number and letter, and indicate your sex and age.

Please use a number 2 pencil. For each item which is true of you, please blacken A. For each item which could apply to you, but is false, blacken B. If the item could not possibly apply to you, because, for example, the item describes your car and you do not own a car, please blacken E.

A= True

B= False

E= Could not apply

For example: If the item said: I always keep my dog leashed when we are walking.

You would mark: A - If you have a dog and always use a leash

B - If you have a dog and do not always use a leash.

E - If you do not have a dog.

1. Within the past five years I have ignored fire or permit regulations in a camping or wilderness area.

2. During the past year I have made no contributions to charity.

3. If I were a farmer with a valuable crop in danger of failing, and the crop could be saved by using a pesticide known to be dangerous to the environment, I would use the pesticide to save my crop.

4. Within the past five years I have written at least one letter to an elected official.

5. I belong to three or more conservation oriented organizations.

6. Suppose you are Tillie or Tommy Toiler and you work in an office at the University. You need to stop off at the grocery on the way home. To remind yourself, you take a paperclip from your desk and clip your grocery list to your paycheck. Suppose that the University hires some office consultants who estimate that the University spends \$500 more a year for paperclips than it needs to; in other words, that \$500 worth of paperclips a year one by one change ownership from the University to its employees. The \$500 could well be spent on a student fellowship. Now that you have heard what the office consultants found out, would you take the paperclip again if you needed to? (Mark A if your answer is yes.)

7. I do not recycle my newspapers.

8. Within the past five years I have helped to push a stalled or stuck car or truck.

9. During the gas shortage I reduced my driving.

10. I did not vote in the most recent election in my precinct.

11. I voted in the most recent campus election.
12. Since the gas shortage I have reduced the amount of driving I do for pleasure (trips to the coast or mountains, for example.)
13. When a project require cooperation from many people in order to succeed I generally do my part even if others do not appear to be joining the effort.
14. I never donate money to political causes.
15. Within the past five years I have purchased an item which I suspected had been stolen.
16. I would be willing to delay pressing for a pay raise in order to aid the fight against inflation.
17. Within the past five years I have attended no public meetings of the city council or other governmental planning or policy organization.
18. I keep the muffler system on my car in good condition.
19. I do not recycle the tin cans I use at home.
20. I vote in almost every public election for which I am eligible.
21. Within the past five years I have driven a vehicle while believing I was intoxicated enough to impair my driving.
22. During the recent energy crisis I kept the temperature where I live at 68 degrees or less.
23. During the past five years I have shoplifted on more than one occasion.
24. I do not belong to any volunteer public service organizations.
25. Since the gas shortage I have increased my use of mass transportation.
26. I recycle the glass jars I use at home.
27. Even if I had no children of my own who would benefit, I would vote to raise my own taxes to improve education.
28. Within the past five years I have violated hunting or fishing regulations.
29. Within the past five years I have not done any shoplifting.
30. I give more money to charity than I can really afford.
31. Within the past five years I have volunteered to testify in court concerning an accident or crime which I happened to observe.
32. During the energy crisis if most other people had ignored the requests to limit electricity use I would also have left my power use unchanged.
33. Within the past five years I have failed to inform a clerk or teller when a financial error in my favor was made.
34. Within the past five years I have burned trash in violation of a city ordinance.
35. Within the past five years I have participated in lobbying for legislation for the general public's welfare.

36. During the recent pollution alert I did not reduce my driving.
37. I have never falsified information on a scholarship or other financial aid application.
38. I belong to three or more volunteer public service organizations.
39. Within the past five years I have cheated on taxes.
40. I have a functioning pollution control device on my car.
41. I belong to a car pool.
42. I have never lent someone a term paper to copy and turn in.
43. Within the past five years I have kept cash from a lost wallet containing identification.
44. Within the past five years I have intervened on the street to help someone who appeared to be in trouble.
45. Within the past five years I have cheated on an exam.
46. If I were engaged in a very competitive business I would not be the first to institute pollution reducing techniques which raised my costs.
47. Within the past five years I have been an active campaign worker in at least one election.
48. Within the past five years I have helped a stranded motorist change a flat tire.
49. I try to minimize the amount of paper I use.
50. Within the past five years I have shoplifted an item worth more than five dollars.
51. Within the past five years I have turned in a term paper which I copied from someone else.
52. I see no point in going out of my way to change any of my personal habits in order to reduce the amount of pollution produced.
53. I am not a registered voter.
54. I never donate money to charity.
55. I plan to limit the number of children I have because I do not wish to contribute to overpopulation.
56. A bunch of environmentalists want people not to drive cars because of the pollution they cause. Suppose you had a friend in Los Angeles who was considering giving up his car for this reason, even though he knows his one car really contributes very little to the entire automobile pollution problem there. Suppose you too lived in Los Angeles and the person who asked your friend also asked you not to use your car, would you do as he asked? (Mark A if you would.)



57. Within the past five years I have shoplifted an item worth more than one dollar.
58. Within the past five years I have not received any traffic tickets for moving violations (speeding, illegal turns, etc.)
59. Within the past five years I have received three or more traffic tickets for moving violations.
60. I have never used a false credit card number or other illegal means to make a long distance phone call.
61. I have never purchased an item which I knew to be stolen.
62. Within the past five years I have falsified information on a job application.
63. I give more money to political causes than I can really afford.
64. Within the past five years I have cleaned up other people's litter from a campsite or other public area.
65. If I owned my own business I would be willing to reduce profits in order to reduce the pollution that the business produced.
66. Within the past five years I have been a blood donor.
67. I have never padded a claim to an insurance company.
68. If I worked in an open shop I would not pay union dues. (An open shop has a union but membership is not required for employment.)
69. Within the past five years I have not helped with any volunteer ad hoc (temporary) community service project.
70. I belong to at least one conservation oriented organization.
71. I have never pocketed a little money from the till at a place that I worked.
72. I would be willing to have a lower standard of living if it would contribute to ending poverty.
73. Within the past year I have not donated any money to charity.
74. Within the past five years I have informed a clerk or teller of a financial error in my favor.
75. I have served in VISTA or the peace corps.
76. I compost the organic waste from my kitchen.
77. I have voted to raise my own taxes to provide increased public services.
78. Since the recent energy crisis I am careful to turn out all lights if I am last to leave a room.
79. Within the past five years I have scratched or dented a parked car without leaving a note to identify myself.
80. I have never stolen a sign as a prank or for a souvenir.



81. We in this country face a dilemma. The President has asked us all to put off purchases, in the hope that if enough of us do this it will slow down inflation. But anyone who has some money to spend will find it has decreased in value if he waits to spend it and inflation does continue. Suppose you were given \$500 by a relative and you could spend it as you choose (that you don't need it to pay any current bills.) Suppose your choices were just to (a) spend it now for some major thing you've long wanted (a stereo set, a vacation in Hawaii, a complete new wardrobe, etc.) or (b) to put off buying what you want for one year and hope that inflation doesn't continue, knowing that if it does, your \$500 will only be worth \$465 at the most. If you would spend it now, please mark A.

82. Within the past five years I have stolen office supplies from my employer.

83. Within the past five years I have volunteered my time as a tutor or big brother/big sister to a child who needed help.

84. I keep my car well tuned up.

85. I contribute more money than I can really afford to conservation organizations.

86. Within the past five years I have falsified information on an application for welfare.

87. Within the past five years I have falsified information on an application for food stamps.

88. Within the past five years I have falsified information on an application for unemployment benefits.

89. Within the past five years I have volunteered to help at a hospital or rest home, by visiting with lonely patients or performing some other temporary service.

90. I plan to have no children of my own because of the world population problem.

### Scoring Behavior Checklist I

Each subject received four scores for Behavior Checklist I. There were three types of items in Behavior Checklist I: antisocial items, prosocial items and commons related items. The four scores for each subject were: an antisocial score, a prosocial score, a commons score and an APC combined score based on all items.

Some items might not apply to every subject. For example, some items referred to ownership of a car. Each subject's score for each of the four scales was expressed as a percentage of applicable items.

Approximately half the items were worded negatively. For these items, a "false" response was considered endorsement of the item and incremented the scale score. Scale scores were calculated according to the following formula:

$$\text{Scale score} = \frac{\text{Number of items endorsed}}{\text{Number of items in the scale minus number of items marked inapplicable}}$$

For the APC combined scale scoring of antisocial items was reversed so that a high APC score reflects low antisocial scores and high prosocial and commons scores.

### Scale Consistency Information For Behavior Checklist I

The Antisocial, Prosocial and Commons scales of Checklist I are listed below. For each scale, the item numbers included in that scale are listed, followed by whether a true or false response incremented the scale for that item and the item-scale correlation for that item based on the 283 subjects in Experiment I.

## Antisocial Scale

<u>Item Number</u>	<u>Keyed Response</u>	<u>Item-Scale Correlation</u>
15	True	.521
21	True	.337
23	True	.608
28	True	.444
29	False	.569
33	True	.264
37	False	.311
39	True	.288
42	False	.420
43	True	.445
45	True	.267
50	True	.532
51	True	.350
57	True	.606
58	False	.328
59	True	.365
60	False	.413
61	False	.500
62	True	.526
67	False	.340
71	False	.452
79	True	.412
80	False	.370
82	True	.348

<u>Item Number</u>	<u>Keyed Response</u>	<u>Item-Scale Correlation</u>
86	True	.363
87	True	.533
88	True	.278

## Prosocial Scale

2	False	.333
4	True	.383
8	True	.120
10	False	.447
11	True	.348
14	False	.510
17	False	.443
20	True	.483
24	False	.454
30	True	.271
31	True	.314
35	True	.523
38	True	.289
44	True	.263
47	True	.531
48	True	.226
53	False	.376
54	False	.370
63	True	.280

<u>Item Number</u>	<u>Keyed Response</u>	<u>Item-Scale Correlation</u>
66	True	.332
69	False	.428
73	False	.489
74	True	.240
75	True	.087
77	True	.461
83	True	.318
89	True	.246

## Commons Scale

1	False	.230
3	False	.238
5	True	-.011
6	False	.306
7	False	.340
9	True	.387
12	True	.388
13	True	.216
16	True	.304
18	True	.287
19	False	.237
22	True	.451
25	True	.359
26	True	.305

<u>Item Number</u>	<u>Keyed Response</u>	<u>Item-Scale Correlation</u>
27	True	.301
32	False	.463
34	False	.272
36	False	.445
40	True	.256
41	True	.130
46	False	.361
49	True	.441
52	False	.456
55	True	.290
56	True	.409
64	True	.195
65	True	.390
68	False	.160
70	True	.228
72	True	.255
76	True	.210
78	True	.346
81	False	.183
84	True	.349
85	True	.167
90	True	.121

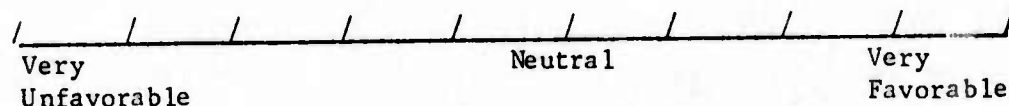
## APPENDIX C

Thurstone Scales--FORM 1 and FORM 2Scale Development

Two Thurstone Scales of tendency to cooperate in large scale social dilemmas were developed from the original 90-item Behavior Checklist I. Fifteen expert judges (faculty and doctoral students in psychology) judged each of the 90 items for extremity on the following nine point scale:

In many situations, a person must choose between individual gain at no cost to one's self but with costs spread over other people, or a contribution to the common good at some cost to one's self and no cost to others.

For each of the 90 items on this questionnaire, please mark a number from 1 to 9 which indicates how much each item expresses favorable or unfavorable feelings toward the common good.



Thurstone Q values were calculated for each of the 90 items.

The Q value is the interquartile range of the judgments, i.e., the range which includes 50% of all judgments. All items with Q values greater than 2.0 were discarded.

Thurstone scale values were also calculated for all items.

The Thurstone scale value is the median of all extremity judgments for each item.

Two 22-item Thurstone scales were created by selecting items



with Q values less than or equal to 2.0 and scale values at approximately equal intervals.

Thurstone FORM 1 and Thurstone FORM 2 are listed below. The item number from Behavior Checklist I is listed, followed by the Thurstone Q value and the Thurstone scale value for that item.

Thurstone FORM 1		
<u>Item Number</u>	<u>Q Value</u>	<u>Thurstone Scale Value</u>
8	0.7	6.1
11	1.2	5.7
13	1.4	7.1
14	0.9	4.1
19	0.7	3.9
20	1.5	6.6
22	0.7	6.9
23	1.6	2.6
27	1.2	7.6
29	1.0	6.4
32	1.3	3.1
39	2.0	2.9
45	1.5	3.7
52	2.0	2.0
55	1.6	7.8
57	1.8	3.6
58	1.1	5.4
60	1.2	5.6

<u>Item Number</u>	<u>Q Value</u>	<u>Thurstone Scale Value</u>
65	1.3	8.2
69	1.2	4.3
72	1.6	8.4
77	1.4	7.4

## Thurstone FORM 2

2	1.1	4.3
7	1.0	3.8
10	1.3	3.6
16	1.4	7.6
21	1.0	2.1
28	1.2	3.3
31	1.0	7.1
36	1.2	2.8
37	1.3	5.4
46	1.5	3.1
48	1.0	6.4
54	1.0	4.2
56	1.9	7.8
59	1.6	3.0
64	1.3	7.4
66	0.9	6.9
67	1.1	5.3
71	1.3	6.1

<u>Item Number</u>	<u>Q Value</u>	<u>Thurstone Scale Value</u>
78	1.3	6.6
81	1.0	4.1
84	1.3	6.1
90	1.9	8.3

Scoring Thurstone FORM 1 and Thurstone FORM 2

A subject's score on Thurstone FORM 1 and Thurstone FORM 2 was mean scale value of all items which were endorsed by the subject on each scale.

## APPENDIX D

### Behavior Checklist FORM 3

#### Scale Development

Behavior Checklist FORM 3 was created by taking the best items from the original 90-item Behavior Checklist I. The correlation with game cooperation in Experiment I was calculated separately for each of the original ninety items. FORM 3 was then composed of those items which met two criteria: they were correlated with game cooperation and they had relatively high item-scale correlations with the scale from which they were drawn.

Six items were drawn from the antisocial scale, six were drawn from the prosocial scale and eleven were drawn from the commons scale.

#### Scoring FORM 3

The scoring of Behavior Checklist FORM 3 was done in the same manner as the scoring of Behavior Checklist I.

The four scores for each subject on Behavior Checklist FORM 3 were: an antisocial score, a prosocial score, a commons score and an APC combined score based on all items.

Each subject's score for each of the four scales was expressed as a percentage of applicable items. For the APC combined scale, scoring of antisocial items was reversed so that a high APC score reflects low antisocial scores and high prosocial and commons scores.

Scale Consistency Information for Behavior

Checklist FORM 3

The antisocial, prosocial and commons scales of Behavior Checklist FORM 3 are listed below. For each scale, the item numbers (from the 90-item Behavior Checklist I) included in that scale are listed, followed by whether a true or false response incremented the scale for that item, and the item-scale correlations for that item from Experiment I and Experiment II.

Item Number in Behavior Checklist I	Keyed Response	Item Scale Correlation		
		Experiment I	Experiment II	
		n = 283	Participants n = 160	Observers n = 149
<u>Antisocial Scale</u>				
23	True	.794	.721	.787
29	False	.790	.770	.777
39	True	.321	.483	.460
43	True	.435	.452	.037
60	False	.594	.543	.618
88	True	.390	.493	.489
<u>Prosocial Scale</u>				
2	False	.563	.573	.532
10	False	.581	.507	.578
47	True	.531	.476	.454
53	False	.529	.626	.580
54	False	.585	.599	.468
69	False	.532	.508	.485

Item Number in Behavior Checklist I	Keyed Response	Item-Scale Correlation		
		Experiment I	Experiment II	
		n = 283	Participants n = 160	Observers n = 149
<u>Commons Scale</u>				
7	False	.493	.471	.569
9	True	.401	.353	.448
19	False	.353	.460	.549
22	True	.527	.476	.487
26	True	.460	.466	.401
34	False	.346	.211	.410
36	False	.435	.430	.415
46	False	.420	.429	.321
49	True	.568	.431	.415
52	False	.454	.307	.441
78	True	.343	.371	.326

## APPENDIX E

Self Judgment: Experiment II

The following one item scale was administered to all participants and observers in Experiment II after the completion of the decision task:

On this nine-point scale, please indicate how you generally react to situations in which you must choose between individual gain at no cost to one's self, but with costs spread over other people, or a contribution to the good of your group at some cost to yourself and no cost to others.

Your ID # \_\_\_\_\_

Circle a number between 1-9

1	2	3	4	5	6	7	8	9
Individual gain					Group gain			



## BIBLIOGRAPHY

- Amidjaja, I. R. and Vinacke, W. E. Achievement, nurturance, and competition in male and female triads. Journal of Personality and Social Psychology, 1965, 2, 447-451.
- Baxter, G. W. Personality and attitudinal characteristics and cooperation in two-person games: A review. In: L. S. Wrightsman, J. O'Connor, and N. J. Baker (Eds.), Cooperation and Competition: Readings on mixed-motive games. Belmont, California: Brooks/Cole, 1972.
- Bixenstine, V. E. and Blundell, J. H. Control of choice exerted by structural factors in two-person non-zero-sum games. Journal of Conflict Resolution, 1966, 10, 478-487.
- Bixenstine, V. E., Chambers, N. and Wilson, K. V. Effects of asymmetry in payoff on behavior in a two-person non-zero-sum game. Journal of Conflict Resolution, 1964, 8, 151-159.
- Bixenstine, V. E., Levitt, C. A. and Wilson, K. V. Collaboration among six persons in a Prisoner's Dilemma game. Journal of Conflict Resolution, 1966, 10, 488-496.
- Bixenstine, V. E., Potash, H. M. and Wilson, K. V. Effects of level of cooperative choice by the other player on choices in a Prisoner's Dilemma game: Part I. Journal of Abnormal and Social Psychology, 1963, 66, 308-313.
- Bixenstine, V. E. and Wilson, K. V. Effects of level of cooperative choice by the other player in choices in a Prisoner's Dilemma game: Part II. Journal of Abnormal and Social Psychology, 1963, 67, 139-147.
- Campbell, D. T. Ethnocentric and other altruistic motives. Nebraska Symposium on Motivation (David Levine, Ed.). University of Nebraska Press, 1965. Pp. 283-311.
- \_\_\_\_\_. On the genetics of altruism and the counter-hedonic components in human culture. Journal of Social Issues, 1972, 28, 21-37.
- Chaney, M. V., Vinacke, W. E. Achievement and nurturance in triads varying in power distribution. Journal of Abnormal and Social Psychology, 1960, 60, 175-181.
- Conger, et al. Personal and interpersonal factors in motor vehicle accidents. American Journal of Psychiatry, 1957, 113, 1069, 1074.
- Dawes, R. M. Formal models of dilemmas in social decision-making. Oregon Research Institute Research Bulletin, 1974, 14 (12). To appear in Kaplan and Schwartz, (Eds.), Human judgment and decision processes: Formal and mathematical approaches.

- Dawes, R. M. and McTavish, J. E. Effect of communication and assumptions about other people on prosocial and antisocial behavior in a commons dilemma situation. Paper presented at the 1975 West Coast Conference on Small Group Research in Victoria, B. C., April 16, 1975.
- \_\_\_\_\_. Effects of cooperation in a Commons Dilemma situation on perceptions of others. (In preparation).
- Deutsch, M. Trust, trustworthiness, and the F. scale. Journal of Abnormal and Social Psychology, 1960, 61, 138-147.
- Dolbear, F. T. and Lave, L. B. Risk orientation as a predictor in the Prisoner's Dilemma. Journal of Conflict Resolution, 1966, 10, 506-515.
- Fishbein, M. and Ajzen, I. Attitudes towards objects as predictors of single and multiple behavioral criteria. Psychological Review, 1974, 81, 59-74.
- Fry, C. L. Personality and acquisition factors in the development of coordination strategy. Journal of Personality and Social Psychology, 1965, 2, 403-407.
- Gillis, J. S. and Woods, G. T. The 16 PF as an indicator of performance in the Prisoner's Dilemma game. Journal of Conflict Resolution, 1971, 15, 393-402.
- Hardin, G. The tragedy of the commons. Science, 1968, 162, 1248-1253.
- Hermann, C. F. Validation problems in games and simulations with special reference to models of international politics. Behavioral Science, 1967, 12, 216-231.
- Kahan, J. P. Rationality, the Prisoner's Dilemma, and population. Journal of Social Issues, 1974.
- Kelley, H. H. and Stahelski, A. V. The social interaction basis of cooperators' and competitors' beliefs about others. Journal of Personality and Social Psychology, 1970, 16, 66-91.
- Klein, E. B. and Solomon, L. Agreement response tendency and behavioral submission in schizophrenia. Psychological Reports, 1966, 18, 499-509.
- Lutzker, D. R. Internationalism as a predictor of cooperative game behavior. Journal of Conflict Resolution, 1960, 4, 426-430.
- MacDonald, A. P. Kessel, V. S. and Fuller, J. B. Self disclosure and two kinds of trust. Psychological Reports, 1972, 30, 143-148.
- Mack, D. Personality, payoff information, and behavior in a two-person bargaining game. Acta Psychologica, 1972, 36, 124-144.

- Marlowe, D. Psychological needs and cooperation-competition in a two-person game. Psychological Reports, 1963, 13, 364.
- McClintock, C. G., Gallo, P. and Harrison, A. A. Some effects of variations in other strategy upon game behavior. Journal of Personality and Social Psychology, 1965, 1, 319-325.
- McClintock, C. G., Harrison, A., Strand, S. and Gallo, P. S. Internationalism, isolationism, strategy of the other player, and two-person game behavior. Journal of Abnormal and Social Psychology, 1963, 67, 631-635.
- McKecwn, C. D., Gahagan, J. P. and Tedeschi, J. T. The effect of prior power strategy on behavior after a shift in power. Journal of Experimental Research in Personality, 1967, 2, 226-233.
- Messick, D. M. To join or not to join: An approach to the unionization decision. Organizational Behavior and Human Performance, 1973, 10, 145-156.
- Meux, E. P. Concern for the common good in an N-person game. Journal of Personality and Social Psychology, 1973, 23, 414-418.
- Moore, M. F. and Mack, D. Dominance-ascendance and behavior in the reiterated Prisoner's Dilemma game. Acta Psychologica, 1972, 36, 480-491.
- Noland, S. J. and Catron, D. W. Cooperative behavior among high school students on the Prisoner's Dilemma game. Psychological Reports, 1969, 24, 711-718.
- Orbell, J. M. and Rutherford, B. M. Can Leviathan make the life of man less solitary, poor, nasty, brutish and short? British Journal of Political Science, 1973, 3, 383-407.
- Phelan, J. G. and Richardson, E. Cognitive complexity, strategy of the other player, and two-person game behavior. Journal of Psychology, 1969, 71, 205-215.
- Pilisuk, M., Potter, P., Rapoport, A. and Winter, J. A. War hawks and peace doves: Alternate resolutions of experimental conflicts. Journal of Conflict Resolution, 1965, 9, 491-508.
- Platt, J. Social traps. American Psychologist, 1973, 28, 641-651.
- Rapoport, Anatol. The uses and misuses of game theory. Scientific American, 1962, 207, 118.
- Richman, J. The concept of cooperation in the Prisoner's Dilemma and other tasks: Some need structure correlates. Proceedings of the Annual Convention of the APA, 1971, 6 Pt. 1, 227-228.

- Schelling, T. C. On the ecology of Micromotives. The Public Interest, 1971, 25, 59-98.
- \_\_\_\_\_. Hockey helmets, concealed weapons, and daylight savings. Journal of Conflict Resolution, 1973, 17, 381-428.
- Scodel, A. Value orientation and preference for a minimum strategy. Journal of Psychology, 1961, 52, 55-61.
- Scodel, A., Ratoosh, P. and Minas, J. S. Some personality correlates of decision making under conditions of risk. Behavioral Science, 1959, 4, 1928.
- Sermat, V. Dominance- submissiveness and competition in a mixed-motive game. British Journal of Social and Clinical Psychology, 1968, 7, 35-44.
- \_\_\_\_\_. Is game behavior related to behavior in other interpersonal situations? Journal of Personality and Social Psychology, 1970, 16, 92-109.
- Sermat, V. and Gregovich, R. P. The effect of experimental manipulations on cooperative behavior in a Chicken game. Psychonomic Science, 1966, 435-436.
- Sherman, R. Personality and strategic choice. Journal of Psychology, 1968, 70, 191-197.
- Smith, W. P. Power structure and authoritarianism in the use of power in the triad. Journal of Personality, 1967, 35, 64-90.
- Speer, D. C. Variations of the Prisoner's Dilemma game as measures of marital interaction: Sequential dyadic measures. Journal of Abnormal Psychology, 1972, 80, 287-293.
- Tedeschi, J. T., Hiester, D. S. and Gahagan, J. P. Trust and the Prisoner's Dilemma game. Journal of Social Psychology, 1969, 79, 43-50.
- Terhune, K. W. Motives, situations, and interpersonal conflict within the Prisoner's Dilemma. Journal of Personality and Social Psychology, Monograph Supplement, 1968, 8, 1-24 (b).
- Uejio, C. K. and Wrightsman, L. S. Ethnic-group differences in the relationship of trusting attitudes to cooperative behavior. Psychological Reports, 1967, 20, 563-571.
- Wood, D., Pilisuk, M. and Uren, E. The martyr's personality: An experimental investigation. Journal of Personality and Social Psychology, 1973, 25, 177-186.

Wrightsman, L. S. Personality and attitudinal correlates of trusting and trustworthy behaviors in a two-person game. Journal of Personality and Social Psychology, 1966, 4, 328-332.

Wrightsman, L. S., O'Connor, J. and Baker, N. J. Cooperation and competition: Readings on mixed-motive games. Belmont, California: Brooks/Cole, 1972.